LPA
IRVINE • SAN DIEGO • SAN JOSE
SACRAMENTO DALLAS • SAN ANTONIO

SPECIFICATIONS AND CONTRACT DOCUMENTS

FOR

ADDISON ATHLETIC CLUB RENOVATIONS

TOWN OF ADDISON, TEXAS
BID NUMBER 21-125

JULY 13, 2021

LPA Project No.: 3006010.00

TOWN OF ADDISON, TEXAS

MAYOR

Joe Chow

MAYOR PRO TEMPORE

Guillermo Quintanilla

DEPUTY MAYOR PRO TEMPORE

Paul Walden

COUNCIL MEMBERS

Tom Braun

Lori Ward

Kathryn Wheeler

Marlin Willesen

CITY MANAGER

Wesley S. Pierson

DEPUTY CITY MANAGER

John Crawford

DIRECTOR OF PARKS AND RECREATION

Janna Tidwell

PROJECT MANUAL

Addison Athletic Club Renovations
Addison, Texas

June 11, 2021 **Construction Documents**

Owner
City of Addison
5300 Belt Line Road
Dallas, Texas 75254

Owner's Representative
Parks & Recreation
16801 Westgrove Drive
Addison, Texas 75001

Architect
LPA Design Studios
Dallas, Texas 75202

Structural Engineer
L.A. Fuess Parnters, Inc.
3333 Lee Pkwy, Suite 300
Dallas, Texas 75219

Mechanical, Electrical and Plumbing Engineers
MEP Consulting Engineers
2928 Story Road West
Irving, Texas 75038

Aquatics Consultant
Aquatic Design Group
226 Faraday Avenue
Carlsbad, California 92008

LPA Project Number: **30060.10**

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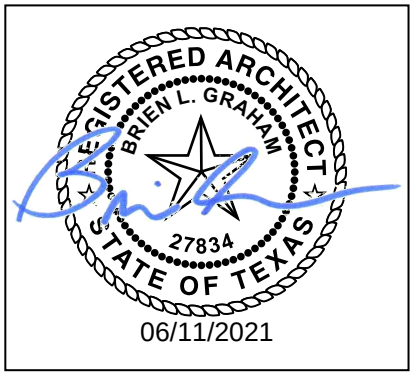
DOCUMENT 00 0107

PROFESSIONAL SEALS PAGE

The specification sections listed below were prepared by or under the direct supervision of the Architect:

LPA Design Studios
1801 North Lamar Street No. 150
Dallas, Texas 75202

SEAL



DIVISION 01 – GENERAL REQUIREMENTS

01 1000	Summary
01 2200	Unit Prices
01 2300	Alternates
01 2500	Substitution Procedures
	Substitution Request Form
01 2600	Contract Modification Procedures
01 2900	Payment Procedures
01 3100	Project Management and Coordination
01 3200	Construction Progress Documentation
01 3233	Photographic Documentation
01 3300	Submittal Procedures
01 3516	Alteration Project Procedures
01 4000	Quality Requirements
01 4200	References
01 5000	Temporary Facilities and Controls
01 6000	Product Requirements
01 7300	Execution
01 7700	Closeout Procedures
01 7823	Operation and Maintenance Data
01 7839	Project Record Documents
01 7900	Demonstration and Training

DIVISION 02 – EXISTING CONDITIONS

02 4113	Selective Site Demolition
02 4119	Selective Demolition

DIVISION 03 – CONCRETE

03 3035	Under Slab Sheet Vapor Retarder
03 5416	Hydraulic Cement Underlayment

DIVISION 04 – MASONRY

04 0110	Masonry Cleaning
04 2000	Unit Masonry

DIVISION 05 – METALS

05 1213	Architecturally Exposed Structural Steel Framing
05 4000	Cold-Formed Metal Framing
05 5000	Metal Fabrications
05 5213	Pipe and Tube Railings

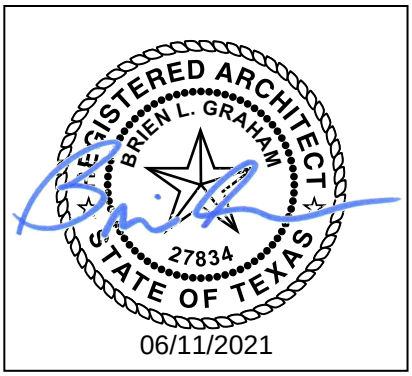
DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

06 1053	Miscellaneous Rough Carpentry
06 1600	Sheathing
06 4116	Plastic-Laminate-Clad Architectural Cabinets
06 4219	Plastic-Laminate-Faced Wood Paneling
06 4600	Wood Trim
06 6400	Plastic Paneling

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 0150.19	Preparation for Re-Roofing
07 2100	Thermal Insulation

07 2726	Fluid-Applied Membrane Air Barriers
07 5552.13	Atactic-Polypropylene (APP) Modified Bituminous Protected Membrane Roofing
07 6200	Sheet Metal Flashing and Trim
07 6210	Flexible Flashing
07 8413	Penetration Firestopping
07 8443	Joint Firestopping
07 9200	Joint Sealants
07 9219	Acoustical Joint Sealants
07 9513.13	Interior Expansion Joint Cover Assemblies
07 9513.16	Exterior Expansion Joint Cover Assemblies



06/11/2021

DIVISION 08 – OPENINGS

08 1113	Hollow Metal Doors and Frames
08 1216	Aluminum Frames
08 1416	Flush Wood Doors
08 3113	Access Doors and Frames
08 4213	Aluminum-Framed Entrances
08 7100	Door Hardware Door Hardware Schedule
08 8000	Glazing
08 8300	Mirrors
08 8700	Glazing Surface Films

DIVISION 09 – FINISHES

09 0561.13	Moisture Vapor Emission Control
09 2216	Non-Structural Metal Framing
09 2900	Gypsum Board
09 3000	Tiling
09 5113	Acoustical Panel Ceilings
09 6513	Resilient Base and Accessories
09 6519	Resilient Tile Flooring
09 6566	Resilient Athletic Flooring
09 6623	Resinous Matrix Terrazzo Flooring
09 6813	Tile Carpeting
09 7200	Wall Coverings
09 8116	Acoustical Blanket Insulation
09 8433	Sound-Absorbing Wall Units
09 9123	Interior Painting
09 9300	Staining and Transparent Finishing
09 9600	High-Performance Coatings

DIVISION 10 – SPECIALTIES

10 1400	Signage
10 1419	Dimensional Letter Signage
10 2600	Wall and Door Protection
10 2800	Toilet, Bath, and Laundry Accessories
10 4413	Fire Protection Cabinets
10 4416	Fire Extinguishers
10 5116	Wood Lockers
10 5123	Plastic-Laminate-Clad Lockers
10 7330	Fabric Sun Screens
10 9900	Miscellaneous Specialties

DIVISION 11 – EQUIPMENT

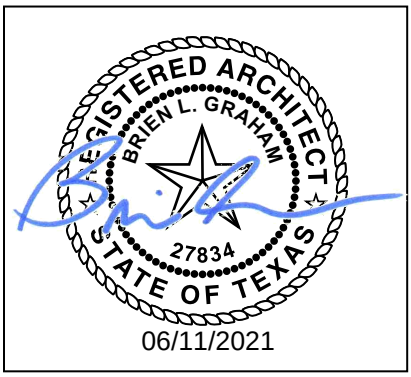
11 2300	Commercial Laundry Equipment
11 3013	Residential Appliances
11 5224	Flat Screen TV Mounts
11 6623	Gymnasium Equipment

DIVISION 12 – FURNISHINGS

12 3661.16 Solid Surfacing Countertops
12 4813 Entrance Floor Mats and Frames

DIVISION 13 – SPECIAL CONSTRUCTION

13 2416 Saunas



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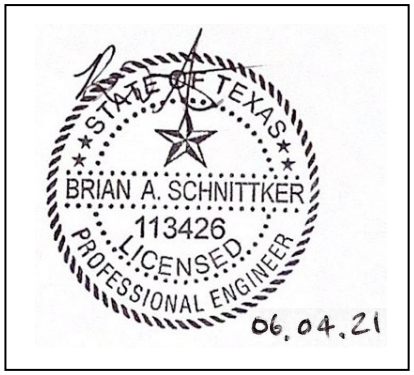
PROFESSIONAL SEALS PAGE

The specification sections listed below were prepared by or under the direct supervision of the Structural Engineer:

L.A. Fuess Partners
3333 Lee Parkway, Suite 300
Dallas, Texas 75219

SEAL



DIVISION 03 – CONCRETE
031110 Structural Concrete Forming
031115 Expanded Polystyrene Foam Block Formwork
031500 Cast-in Anchors and Embeds
032000 Concrete Reinforcing
033100 Structural Concrete

DIVISION 05 – METALS
051200 Structural Steel Framing

DIVISION 31 – EARTHWORK
316329 Drilled Concrete Piers

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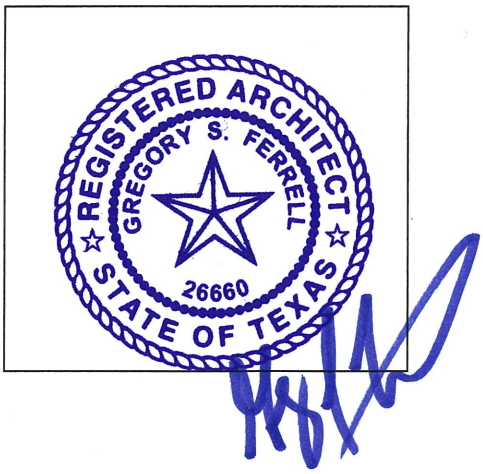
PROFESSIONAL SEALS PAGE

The specification sections listed below were prepared by or under the direct supervision of the Swimming Pool Architect:

AQUATIC DESIGN GROUP
2226 Faraday Avenue
Carlsbad, CA 92008

SEAL



DIVISION 13 – SPECIAL CONSTRUCTION

13 1100 Swimming Pool General Requirements
13 1101 Swimming Pool Excavation
13 1102 Swimming Pool Concrete
13 1103 Swimming Pool Shotcrete
13 1104 Swimming Pool Ceramic Tile
13 1105 Swimming Pool Plaster
13 1106 Swimming Pool Equipment
13 1107 Swimming Pool Mechanical
13 1108 Swimming Pool Electrical

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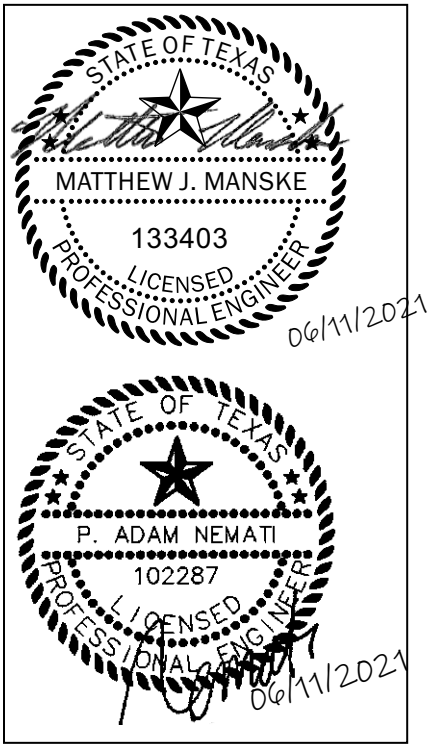
PROFESSIONAL SEALS PAGE

The specification sections listed below were prepared by or under the direct supervision of the Mechanical Engineer:

MEPCE
2928 Story Road West.
Las Colinas, Texas 75038
(972) 870-9060

SEAL



DIVISION 21 – FIRE SUPPRESSION
210500 Common Work Results for Fire Suppression
211000 Water Based Fire Suppression Systems

DIVISION 22 – PLUMBING
220500 Common Work Results for Plumbing
220519 Meters and Gages for Plumbing Piping
220523 General Duty Valves for Plumbing Piping
220529 Hangers and Supports for Plumbing Piping and Equipment
220553 Identification for Plumbing Piping and Equipment
220700 Plumbing Insulation
221116 Domestic Water Piping
221119 Domestic Water Piping Specialties
221125 Facility Natural Gas Piping
221316 Sanitary Waste and Vent Piping
221319 Sanitary Waste Piping Specialties
223400 Fuel Fired Domestic Water Heaters
224000 Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING
230500 Common Work Results for HVAC
230519 Thermometers and Gages for HVAC Piping
230523 General Duty Valves for HVAC Piping
230529 Hangers and Supports for HVAC Piping and Equipment
230553 Identification for HVAC Piping and Equipment
230593 Testing, Adjusting, and Balancing For HVAC
230700 HVAC Insulation
230925 Variable Frequency Drives
232113 Hydronic Piping
232123 Hydronic Pumps
233113 Metal Ducts
233300 Air Duct Accessories
233423 HVAC Power Ventilators
233600 Air Terminal Units
233713 Diffusers, Registers, and Grilles
237313 Modular Indoor Central Station Air Handling Units
238126 Split System Air Conditioners
238416 Indoor, Mechanical Dehumidification Units

DIVISION 26 – ELECTRICAL
260500 Common Work Results for Electrical
260519 Low Voltage Electrical Power Conductors
260526 Grounding and Bonding
260529 Hangers and Supports
260533 Raceway and Boxes
260553 Identification for Electrical Systems
260943 Network Lighting Controls
262416 Panelboards
262726 Wiring Devices
262816 Enclosed Switches and Circuit Breakers
265100 Interior Lighting

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TABLE OF CONTENTS

INDEX OF ISSUES

Construction Documents ..... 11 June 2021

END OF TABLE OF CONTENTS

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TABLE OF CONTENTS

SECTION RP

REQUEST FOR PROPOSALS

REQUEST FOR PROPOSALS

1. The Town of Addison is requesting competitive sealed proposals for the construction for Addison Athletic Club Renovations in accordance with the bid documents prepare by LPA Architects. Sealed **Proposals will be accepted until 2:00 p.m., Thursday, August 12, 2021**at the Finance Building, 5350 Belt Line Rd., Dallas, Texas 75254 – Attention Purchasing Department, atwhich time offerors' names and monetary proposals will be publicly read aloud. Late proposals will not be considered. The plans, specifications, quantities, pre-proposal conference time and date, and other information are available on www.bidsync.com.. The Town of Addison reserves the right to waive any formalities, to reject any and all proposals, and to select the proposal deemed most advantageous to the Town of Addison.

   This Request for Proposals (RFP) is a completive sealed proposal method in accordance with the Texas Government Code Chapter 2269, Subchapter D.

2. The Contractor shall identify his proposal on the outside of the envelope by writing the words "**PARKS AND RECREATION DEPARTMENT PROPOSAL 21-125, ADDISON ATHLETIC CLUB RENOVATIONS."**

   PAPER PROPOSALS SHALL BE REQUIRED.

3. Proposals shall be accompanied by a bid bond in an amount not less than five percent (5%) of the total maximum proposal price payable without recourse to the Town of Addison as a guarantee that the offeror will enter into a contract and execute required Bonds within ten (10) calendar days after notice of award of contract to him. The bid bond shall be from a reliable surety company licensed by the State of Texas to act as a Surety and be listed on the current U.S. Treasury Listing of Approved Sureties

4. Plans, specifications and proposal documents may be downloaded from www.bidsync.com. The Town of Addison is a "free buyer", meaning that prospective offerors need only a free registration to sign up for plan updates. Offerors assume all risk for acquiring specs and/or plans from third party sites and plan rooms, as only Bidsync.com will be directly updated by the Town Addison.

5. The right is reserved by the Mayor and the City Council as the interests of the Town may require to reject any or all proposals and to waive any formality in proposals received and to select the proposal deemed most advantageous to the Town.

6. The Offeror (Proposer) must supply all the information required by the Proposal Form.

7. A Performance Bond, Labor and Material Payment Bond, and Maintenance Bond will be required by the Owner; each Bond shall be in the amount of 100% of the total contract amount. Bonds shall be issued by a surety company licensed by the State of Texas to act as a Surety and be listed on the current U.S. Treasury Listing of Approved Sureties.

8. The Offeror (Proposer) must supply all the information required by the Offeror Qualification Statement.

9. **A mandatory pre-proposal conference will be held on Tuesday, July 27th at 10:00 am at the Addison Athletic Club located at 3900 Beltway Dr. Addison, TX.**

10. For information on the proposal or work to be performed, please submit all questions on Bidsync. **All questions must be received by 5:00pm on Wednesday, July 28, 2021. All questions received bythis deadline will be answered by 5:00pm on Monday, August 2, 2021.**

11. **The project consists of renovation related to the Locker Rooms, Walking Track , Indoor Pool, Outdoor Pool, Main Lobby, Receptions Desk, Staff Offices and Community Spaces at the Addison Athletic Club.**

Town of Addison

REQUEST FOR PROPOSAL TERMS AND CONDITIONS

1. APPLICABILITY: These standard Terms and Conditions and the Terms and Conditions, Specifications, Drawings and other requirements included in the Town of Addison's Request for Proposal (collectively, "Terms and Conditions") are applicable to Contracts/Purchase Orders issued by the Town of Addison (hereinafter referred to as the "Town" or "Buyer") and the Seller (herein after referred to as the "Seller," "Proposer," "Contractor," or "Supplier"). Any deviations must be in writing and signed by a representative of the Town's Purchasing Department and the Supplier. No Terms and Conditions contained in the Seller's Proposal, Invoice or Statement shall serve to modify the terms set forth herein. If there is a conflict between the Terms and Conditions and the provisions on the face of the Contract/Purchase Order, the Terms and Conditions will take precedence and control.

2. OFFICIAL PROPOSAL NOTIFICATION: The Town utilizes the following for official notifications of proposal opportunities: www.bidsync.com and the Dallas Morning News of Dallas County. These are the only forms of notification authorized by the Town. The Town is not responsible for receipt of notifications or information from any source other than those listed. It shall be the Supplier's responsibility to verify the validity of all Request for Proposal information received from any source other than the Town. There will be NO COST to the Seller for using BidSync for its Bids/Proposals.

3. PRIOR OR PENDING LITIGATION OR LAW SUITS: Each Proposer must include in its proposal a complete disclosure of any alleged significant prior or ongoing contract failures, any civil or criminal litigation or investigation pending which involves the Proposer or in which the Proposer has been judged guilty or liable.

4. COST OF RESPONSE: Any cost incurred by the Supplier in responding to the Request for Proposal is the responsibility of the supplier and cannot be charged to the Town.

5. PROHIBITION AGAINST PERSONAL INTEREST IN CONTRACTS: No Town of Addison employee shall have a direct or indirect financial interest in any contract with the Town, or be directly or indirectly financially interested in the sale of land, materials, supplies or services to the Town.

6. COMPETITIVE PRICING: It is the intent of the Town to consider Interlocal Cooperative Agreements and State/Federal contracts in determining the best value for the Town.

7. INTERLOCAL AGREEMENT: The successful Proposer agrees to extend prices to all entities that have entered into or will enter into joint purchasing interlocal cooperation agreements with the Town. The Town is a participating member of several interlocal cooperative purchasing agreements. As such, the Town has executed interlocal agreements, as permitted under Chapter 791 of the Texas Government Code, with certain other political subdivisions, authorizing participation in a cooperative purchasing program. The successful Supplier may be asked to provide products/services based upon terms and conditions of award, to any other participant in a cooperative purchasing program.

8. CORRESPONDENCE: The proposal number must appear on all correspondence and inquiries pertaining to the Request for Proposal. The Purchase Order number must appear on all invoices or other correspondence relating to the contract.

9. INDEMNITY/INSURANCE: See attached Town of Addison minimum requirements.

10. ERROR-QUANTITY: Proposals must be submitted in units of quantity specified, extended, and totaled. In the event of discrepancies in extension, the unit prices shall govern.

11. ACCEPTANCE: The right is reserved to accept or reject all or part of the proposal or offer, and to

accept the proposal or offer considered most advantageous to the Town by line item or total offer or proposal.

12. PROPOSAL LIST REMOVAL: The Town reserves the right to remove a Supplier from any Proposal list for: (1) continued failure to be responsive to the Town, (2) failure to deliver merchandise within promised time, (3) delivery of substandard merchandise, or (4) failure to comply with the Contract/Purchase Order requirements.

13. CONTRACT RENEWAL OPTIONS: In the event a clause for option to renew for an additional period is included in the Request for Proposal, all renewals will be based solely upon the option and agreement between the Town and the Supplier. Either party dissenting will terminate the contract in accordance with its initial specified term.

14. TAXES-EXEMPTION: All quotations are required to be submitted LESS Federal Excise and State Sales Taxes. Tax Exemption Certificate will be executed for the successful Supplier.

15. ASSIGNMENT AND SUCCESSORS: The successful Supplier shall not assign, transfer, pledge, subcontract, or otherwise convey, in any manner whatsoever, any contract resulting from this proposal, in whole or in part, without the prior written consent of the Town of Addison.

16. INVOICING: Send ORIGINAL INVOICE to address indicated on the contract/purchase order. If invoice is subject to cash discounts the discount period will begin on the day invoices are received. So that proper cash discount may be computed, invoice should show amount of freight as a separate item, if applicable; otherwise, cash discount will be computed on total amount of invoice.

17. ELECTRONIC SIGNATURE – UNIFORM ELECTRONIC TRANSACTION ACT: The Town adopts Texas Business and Commerce Code Chapter 322, Uniform Electronic Transactions Act, allowing individuals, companies, and governmental entities to lawfully use and rely on electronic signatures.

18. FUNDING OUT CLAUSE: This agreement or contract may be terminated by the Town without notice and without penalty or liability in the event that (1) the Town lacks sufficient funds for this agreement or contract; (2) funds for this agreement or contract are not appropriated by the Town Council of the Town; and (3) funds for this agreement or contract that are or were to be provided by grant or through an outside service are withheld, denied or are otherwise not available to the Town.

19. DISPUTE RESOLUTION: Pursuant to subchapter I, Chapter 271, TEXAS LOCAL GOVERNMENT CODE, Contractor agrees that, prior to instituting any lawsuit or other proceeding arising from any dispute or claim of breach under this Agreement (a "Claim"), the parties will first attempt to resolve the Claim by taking the following steps: (i) A written notice substantially describing the factual and legal basis of the Claim shall be delivered by the Contractor to the Town within one-hundred eighty (180) days after the date of the event giving rise to the Claim, which notice shall request a written response to be delivered to the Contractor not less than fourteen (14) business days after receipt of the notice of Claim; (ii) if the response does not resolve the Claim, in the opinion of the Contractor, the Contractor shall give notice to that effect to the Town whereupon each party shall appoint a person having authority over the activities of the respective parties who shall promptly meet, in person, in a effort to resolve the Claim; (iii) if those persons cannot or do not resolve the Claim, then the parties shall each appoint a person from the highest tier of managerial responsibility within each respective party, who shall then promptly meet, in person, in an effort to resolve the Claim.

20. DISCLOSURE OF CERTAIN RELATIONSHIPS: Chapter 176 of the Texas Local Government Code requires that any person, as defined in the statute, considering doing business with a local government

entity disclose in the Questionnaire Form CIQ, the supplier or person's affiliation or business relationship that might cause a conflict of interest with a local government entity. By law, this questionnaire must be filed with the Records Administrator of the Town not later than the 7th business day after the later of (a) the date the person (i) begins discussions or negotiations to enter into a contract with the local governmental entity, or (b) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity, or (b) the date the person becomes aware (i) of an employment or other business relationship with a local government officer, or a family member of the officer, described by the statute, or (ii) that the person has given one or more gifts described in the statute. See Section 176.006, Local Government Code. A person commits an offense if the person violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor. The questionnaire may be found at www.ethics.state.tx.us/forms/CIQ.pdf By submitting a response to this request, Supplier represents that it is in compliance with the requirements of Chapter 176 of the Texas Local Government Code.

21. PATENTS: Seller agrees to **indemnify and hold harmless** the Buyer against all costs and expenses, including but not limited to attorneys fees, and undertakes and **agrees to defend** at seller's own expense, all suits, actions or proceedings in which Buyer or the users of Buyer's products are claimed to have conducted in, or are made defendants of, actual or alleged infringement of any U.S. or foreign patent or other intellectual property right resulting from the use or sale of the items purchased hereunder and further agrees to pay and discharge any and all judgments or decrees which may be rendered in any such suit, action or proceeding.

22. APPLICABLE LAW: This agreement shall be governed by the laws of the State of Texas, including but not limited to the Uniform Commercial Code as adopted by the State of Texas, as effective and in force on the date of this agreement, without regard to its conflict of laws rules or the conflict of law rules of any other jurisdiction.

23. VENUE**:** This agreement is performable in Dallas County, Texas, and venue for any suit, action, or legal proceeding under or in connection with this agreement shall lie exclusively in Dallas County, Texas. Proposer submits to the exclusive jurisdiction of the courts in Dallas County, Texas for purposes of any such suit, action, or proceeding hereunder, and waives any claim that any such suit, action, or legal proceeding has been brought in an inconvenient forum or that the venue of that proceeding is improper.

24. TERMINATION FOR CAUSE OR CONVENIENCE: The Town at any time after issuance of this agreement, by 30 days written notice to the Supplier, has the absolute write to terminate this agreement for cause or for convenience (that is, for any reason or no reason whatsoever). "Cause" shall be the Supplier's refusal or failure to satisfactorily perform or complete the work within the time specified, or failure to meet the specifications, quantities, quality and/or other requirements specified in the Contract/Purchase Order. In such case the Supplier shall be liable for any damages suffered by the Town. If the agreement is terminated for convenience, the Supplier has no further obligation under the agreement. Payment shall be made to cover the cost of material and work in process or "consigned" to the Town as of the effective date of the termination.

25. FORCE MAJEURE: To the extent either the Town or Proposer shall be wholly or partially prevented from the performance of this agreement or of any obligation or duty under this agreement placed on such party, by reason of or through work strikes, stoppage of labor, riot, fire, flood, acts of war, insurrection, court judgment, act of God, or other specific cause reasonably beyond the party's control and not attributable to its malfeasance, neglect or nonfeasance, then in such event, such party shall give notice of the same to the other party (specifying the reason for the prevention) and the time for performance of such obligation or duty shall be suspended until such disability to perform is removed.

26. BAFO: During evaluation process Town reserves the right to request a best and final offer upon completion of negotiations.

27. PROTECTION OF TRADE SECRETS OR PROPRIETARY INFORMATION: Proposals will be received and publicly acknowledged at the location, date, and time stated. Sellers, their representatives and interested persons may be present. The proposals shall be received and acknowledged only so as to avoid disclosure of the contents to competing sellers and kept secret during negotiation. However, all proposals shall be open for public inspection after the contract is awarded. Trade secrets and confidential information contained in the proposal and identified by Seller in writing as such will be treated as confidential by the Town the extent allowable in the Texas Public Information Act and other law.

28. SILENCE OF SPECIFICATIONS: The apparent silence of these specifications as to any detail or to the apparent omission from it of a detailed description concerning any point, shall be regarded as meaning that only the best commercial practices are to prevail. All interpretations of these specifications shall be made on the basis of this statement.

29. PROPOSAL RESPONSE CONTRACTUAL OBLIGATION: This proposal, submitted documents, and any negotiations, when properly accepted by the Town, shall constitute a contract equally binding between the successful Proposer and the Town. No different or additional terms will become part of this contract except as properly executed in an addendum or change order.

30. NO BOYCOTTING ISRAEL. The entity contact with the Town of Addison does not boycott Israel and will not boycott Israel during the term of the contract. Reference HB 89 as it relates to Chapter 2270 of the Texas Government Code. Boycott Israel means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

31. NO INDUSTRY DISCRIMINATION. The entity contracting with the Town of Addison does not discriminate against firearm and ammunition industries during the term of the contract. Reference SB 19 as it relates to Chapter 2251 of the Texas Government Code. Discriminating means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with the firearm or ammunition industry or with a person or entity doing business in the firearm or ammunition industry but does not include an action made for ordinary business purposes.

SECTION IO

INSTRUCTIONS TO OFFERORS

INSTRUCTIONS TO OFFERORS

A. PROJECT: ADDISON ATHLETIC CLUB RENOVATIONS PROJECT, in the Town of Addison. The proposals will be evaluated as stated in Section "N" of these Instructions to Offerors.

B. PROJECT DESCRIPTION: The project consists of renovation and reconfiguration of locker room to include the addition of family changing suites, replacement of walking track railing and surfacing, reconfiguration of the reception desk / staff area, securing upstairs staff offices, replacement of indoor hot tub, upgrade of indoor / outdoor pool filtrations equipment, installation of outdoor shade structure, replacement of a small outdoor water feature, roof replacement, HVAC system modifications and core building improvements related to flooring, painting and lighting.

C. PROPOSALS: Proposals must be in accordance with these instructions in order to receive consideration.

D. DOCUMENTS: Proposal Documents include the Project Manual (consisting of the Request for Proposals, these Instructions to Offerors, Proposal Forms, Reference Form, Contract Agreement, Performance Bond, Payment Bond, Maintenance Bond, Contractor's Affidavit of Bills Paid, General Provisions, Special Provisions, Project Sign, and Technical Specifications), a Waiver of Lien, Drawings, and Addenda which may be issued by the Town of Addison during the proposal period. Proposal Documents may be viewed and/or obtained under the terms and conditions set forth in the Request for Proposals, Section RP of this Project Manual.

E. EXAMINATION OF DOCUMENTS AND SITE: Offerors shall carefully examine the Proposal Documents and the construction site to obtain firsthand knowledge of the scope and the conditions of the Work. Each Contractor, Subcontractor and Sub-subcontractor, by submitting a proposal to perform any portion of the Work, represents and warrants that they have examined the Drawings, Specifications (Project Manual) and the site of the Work, and from their own investigation has satisfied themselves as to the scope, accessibility, nature and location of the Work; the character of the equipment and other facilities needed for the performance of the Work; the character and extent of other work to be performed; the local conditions; labor availability, practices and jurisdictions; and other circumstances that may affect the performance of the Work. The Contractor acknowledges that this is an Residential Area Construction Project and will require methods and equipment that minimize noise, dust and vibration. Limited work and storage area is available in the Project Area. No additional compensation will be allowed by the Owner for the failure of such Contractor, Subcontractor or Sub-subcontractor to inform themselves as to conditions affecting the Work.

F. INTERPRETATION OF DOCUMENTS: If any person contemplating submitting a proposal for the proposed Contract is in doubt as to the meaning of any part of the Drawings, Specifications (Project Manual) or other proposed Contract Documents, they may submit questions to the Town of Addison, no later than **5:00pm on Wednesday, July 28, 2021. All questions received by this deadline will be answered by 5:00pm on Monday, August 2, 2021.** Offerors should act promptly and allow sufficient time for a reply to reach them before preparing their proposals. Any interpretation or clarification will be in the form of an Addendum duly issued. No alleged verbal interpretation or ruling will be held binding upon the Owner.

G. SUBSTITUTIONS: Conditions governing the submission of substitutions for specific materials, products, equipment and processes are in the General Provisions (NCTCOT 106.1 *Substitution of Materials*). Requests for substitutions or alternate items prior to the opening of proposals must be received by the Town of Addison no later than **Wednesday, July 28, 2021.** Pay item unit prices based on alternate items not approved prior to the established proposal date are at the risk of the Contractor.

H. ADDENDA: Interpretations, clarifications, additions, deletions and modifications to the Documents during the proposal period will be issued in the form of Addenda and a copy of such Addenda will be released through www.bidsync.com. It will be the responsibility of each person who has been issued a set of proposal documents to secure all Addenda from www.bidsync.com. Addenda will be a part of the Proposal Documents and the Contract Documents, and receipt of them shall be acknowledged in the Proposal Form. All such interpretations and supplemental instructions will be in the form of written addenda to the contract documents which, if issued, will be released through www.bidsync.com not later than three (3) calendar days prior to the date fixed for the opening of proposals. If any offeror fails to acknowledge the receipt of such addenda in the space provided in the proposal form, their proposal will nevertheless be construed as though the receipt of such addenda had been acknowledged.

I. EVALUATION OF PROPOSALS:

1. Within 45 days after the date of opening the Proposals, the Owner will evaluate and rank each Proposal with respect to the selection criteria described in Section "N" of these Instructions to Offerors. All procurements shall conform to Texas Government Code Chapter 2269. In evaluating Proposals, the Owner will consider whether or not the Proposals comply with the prescribed requirements, and such alternatives, prices and other data, as may be requested in the Proposal Form or may be requested from Offerors prior to a Notice of Award.

2. In evaluating Proposals, the Owner will consider the Contract Price, Offeror Qualification Statement and other requested information to determine which Proposal offers the best value to the Owner. The Proposals will be evaluated using the information submitted in the Proposal Form and information submitted in the Offeror Qualification Statement.

3. Owner may conduct such investigations as the Owner deems necessary to establish the responsibility, qualifications, and financial ability of contractors, individuals, or entities proposed to furnish parts of the Work in accordance with the Contract Documents.

4. The Owner may request Offeror Interviews as a portion of the evaluation and selection process.

5. The evaluation criteria and weighting are as described in this RFP.

6. Submission of a Proposal indicates the Offeror's acceptance of the evaluation technique and methodology as well as the Offeror's recognition that some subjective judgments must be made by the Owner during the evaluation.

J. COMPLETION TIME: The selected contractor shall use the time period between the awarding of the contract at Town Council and the date of Notice to Proceed to submit materials, shop drawings, a detailed construction schedule, traffic control plan, SWPPP and other items needed to move forward with construction activities, for acceptance by The Town. The Town shall

review and return these submittals in the most expedient manner possible to accommodate immediate material ordering. Review time will vary based on the number of submittals under review at any given time.

The term “Contract Time” as used in this Provision will mean the sum of the calendar days proposed by the contractor on the proposal form to achieve substantial completion for the entire project, a total of _____ calendar days. The term “calendar day” as used in this Article will mean every day shown on the calendar. The term "substantial completion" means that the improvements have been made suitable for use or occupancy or the facility is in condition to serve its intended purpose, but still may require minor miscellaneous work and adjustment, as determined by the Owner. Calendar days will be consecutively counted from commencement of Contract Time (issuance of a Notice to Proceed) regardless of weather, weekends, and holidays, suspensions of Contractor’s operations, delays or other events as described herein.

Substantial Completion for the project includes the following items:

i. Completion of **all work** included in the Contract Documents.

ii. A Punchlist walk-through with the Town will be performed for this segment and provided to the Contractor. If elements of the project are not complete or numerous defects and/or deficiencies are found during the walk-through, the walk-through will be suspended and Contractor will be required to perform their own Quality Control walk-through and make corrections as needed. Once Contractor’s Quality Control corrections has been completed, Contractor shall request another walk-through;

iii. The Contractor will have thirty (30) days to correct the items on the walk-through Punchlist and request a re-inspection from the Town. If Contractor fails to correct all repairs in this timeframe, Contract Time will be restarted.

Final Acceptance will be issued after Substantial Completion items have been addressed.

K. PREPARATION OF PROPOSALS: Prices quoted shall include all items of cost, expense, taxes, fees and charges incurred by, or arising out of, the performance of the work to be performed under the Contract. Three (3) copies of complete Proposals shall be submitted and shall have original signatures signed in ink. An electronic version of the proposal submitted shall also be submitted, in PDF format on a USB drive. Any proposal on other than the required form will be considered informal and may be rejected. Erasures or other changes in a proposal must be explained or noted over the initials of the offeror. Proposals containing any conditions, omissions, unexplained erasures and alterations, or irregularities of any kind may be rejected as informal. In the case of a discrepancy between a unit price and its extension, the unit price will govern. Failure to submit all requested information will make a proposal irregular and subject to rejection. Proposals shall be signed with name typed or printed below signature, and, if a partnership, give full name of all partners. Where offeror is a corporation, proposals must be signed with the legal name of the corporation followed by the name of the state of incorporation and the legal signature of an officer authorized to bind the corporation to a contract.

NOTE: AN ELECTRONIC SPREADSHEET IS POSTED ON BIDSYNC FOR CONTRACTORS CONVENIENCE

L. SUBMITTAL OF PROPOSALS: Sealed proposals will be received at the time, date and place stated in the Request for Proposals. Proposals shall be made on unaltered Proposal Forms furnished by the Town of Addison. Offerors shall submit proposals in an opaque, sealed envelope addressed to the Owner and plainly mark on the outside of the envelope the name andaddress of the offeror. Three (3) paper copies of complete Proposals shall be submitted and shallhave original signatures signed in ink. An electronic version of the complete proposal submittedshall also be submitted, in PDF format on a USB drive. The envelopes shall also be marked with the following project description:

PARKS & RECREATION PROPSOAL NUMBER 21-125
Addison Athletic Club Renovations

The Bid Bond must be completed and signed by each offeror and submitted with the proposal. Submit proposals by mail or in person prior to the time for receiving proposals set forth in the Request for Proposals issued by the Town.

Electronic proposals submitted on bidsync.com will not be considered for this project. Paper proposal submittals are required. The Town of Addison uses Bidsync to distribute bids and proposals. There will be NO COST to the contractor for standard proposals.

M. MODIFICATION AND WITHDRAWAL OF PROPOSALS: Prior to the time set for proposal opening, proposals may be withdrawn or modified. Proposals may be modified only on the official proposal form and must be signed by a person legally empowered to bind the offeror. No offeror shall modify, withdraw, or cancel their proposal or any part thereof for sixty (60) calendar days after the time agreed upon for the receipt of proposals.

N. DISQUALIFICATION: The Owner reserves the right to disqualify proposals, before or after the opening, upon evidence of collusion with intent to defraud or other illegal practices relating to this proposal upon the part of the offeror.

O. EVALUATION CRITERIA AND WEIGHTING: The Owner will consider the Contract Price, Statement of Qualifications and other criteria requested of the Offerors to determine which Proposal offers the best value to the Owner. The Proposals will be evaluated using the criteria and weighting described below:

Rating Category	Description	Weighting Value %
A	Proposed Contract Price	50
B	Qualifications – Relevant work experience, project team, key personnel.	25

C	Project Delivery Approach - Construction schedule showing ability to sequence, stage and complete the project in a timely manner while building remains in operation and open to members.	15
E	Construction Time	10
	Total	100

The Owner reserves the right to take into account in its evaluation of the Price Proposal, the Total Proposal Amount on the Proposal Form as to its reasonableness for the actual cost of the work to complete the scope of work for this Project. The Owner may take into account the increased risk for contract performance problems that a significantly low Total Proposal Amount could represent.

P. AWARD: The Offeror selected for award of the Contract will be the Offeror whose offer provides the best value to the Owner. The Owner is not bound to accept the lowest priced Proposal if that Proposal is not in the best value to the Owner, as determined by the Owner. If the Owner determines that it is unable to reach a contract satisfactory to the Owner with the selected Offeror, then the Owner will terminate discussions in writing with the selected Offeror and proceed to the next Offeror in order of selection ranking until an agreement is reached or the Owner has rejected all Proposals.

Owner reserves the right to reject any and all Proposals, including without limitation, nonconforming, non-responsive, or conditional Proposals. The Owner may also reject the Proposal of any Offeror if the Owner believes that it would not be in the best interest of the Owner to make an award to that Offeror. The Owner reserves the right to waive all formalities.

More than one Proposal for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Offeror has an interest in more than one Proposal for the Work shall be cause for disqualification of that Offeror and the rejection of all Proposals in which that Offeror has an interest.

Alternate items may or may not be awarded. Addition or deletion of other items or schedules will be governed by the *Standard Specifications for Public Works Construction – North Central Texas, November 2017, 5th Edition*, (Latest Version) (hereinafter called NCTCOG) Item 104.2 "Change or Modification of Contract".

Q. EXECUTION OF THE CONTRACT: The successful offeror will be required to enter into a contract with the Owner within ten (10) working days of notice by the Owner that their proposal has beenaccepted. Failure to enter into a contract within the established time limit shall be considered grounds for forfeiture of the bid bond.

R. CONSTRUCTION SCHEDULE: It is the Owner's desire to have the project completed and operational in as short a time as possible within the parameters included in the Contract Documents. The number of calendar days for completion of the project will begin with the date specified in the Notice to Proceed. The Notice to Proceed will be issued in a manner to facilitate a smooth construction of the project. The Contractor shall begin construction within ten (10) working days of the issuance of the Notice to Proceed.

S. COST PLUS TIME BIDDING: N/A

T. FORM OF CONTRACT: The contract for the construction of the project will be drawn up by the Owner. A sample form of agreement is included in the Contract Agreement Section.

U. BONDS: A Performance Bond, a Labor and Material Payment Bond will be required once the contract is executed. A Maintenance Bondwill be required by the Owner once prior to final acceptance being issued. The Performance Bond and Payment Bond shall name the Townof Addison, and others as directed by the Town, as joint obligees. Sample forms have been included in the Performance Bond, Payment Bond, and Maintenance Bond sections. (Contractorshall confirm the legal names of obligees prior to execution of Bonds.)

V. BID SECURITY: Proposals shall be accompanied by a bid bond in an amount not less than five percent (5%) of the total maximum proposal price payable without recourse to the Town of Addison as a guarantee that the offeror will enter into a contract and execute a Performance Bond and Payment Bond within ten (10) working days after notice of award of contract to him. The bid bond shall be from a surety company licensed to do business in the State of Texas.

W. RESOLUTIONS: If the offeror is a corporation, a copy of the resolution empowering the person submitting the proposal to bind the offeror must be included with the proposal.

X. FINAL PAYMENT: The general provisions for Final Payment shall be as stated in Item 109.5.4 of the NCTCOG including all Amendments and Additions. Prior to final payment the Contractor shall provide the Owner with the following items:

1. A Contractor's Affidavit of Bills Paid in accordance with Section BP.A Consent of Surety Company to Final Payment.
2. Record Documents which indicate all construction variations from the original construction documents in accordance with the Special Provisions.
3. A one (1) year Maintenance Bond in accordance with Section MB.
4. Documentation that shows the construction has been reviewed and accepted by TDLR.

Y. PRIORITY OF CONTRACT DOCUMENTS: In case of conflict between contract documents, priority of interpretation shall be in the following order:

Signed Agreement;
Performance and Payment Bonds;
Information and Instruction Form
Proposal;
Project Drawings;
Special Provisions (or conditions);
Technical Specifications;

General Provisions:

This priority list shall take precedence over Item 105.1.1 of the NCTCOG.

Standards by reference:

- *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges* adopted by the Texas Department of Transportation November 1, 2014;
- Standard Specifications for Public Works Construction (NCTCOG, November 2017) ,(Latest Version);
- Town of Addison Standard Drawings.
- Specific call outs for specifications or standards shall take precedence over general statements.

SECTION PF-1

PROPOSAL FORM

PROPOSAL FORM

TO: The Honorable Mayor and Town Council
Town of Addison, Texas

The undersigned Offeror, having examined the plans, specifications and contract documents, and the location of the proposed work, and being fully advised as to the extent and character of the work, proposes to furnish all material, equipment and to perform all labor and work necessary for completion of the work described by and in accordance with the Contract Documents and Contract for the following prices, to wit:

Signed by: _____

Printed Name: Matt Tucker

Title: President

Business Name: Northridge Construction Group, LLC

Date: 08/19/2021

ACKNOWLEDGMENT OF ADDENDA:

The Offeror acknowledges receipt of the following addenda:

Addendum No. 1 _____

Addendum No. 2 _____

Addendum No. 3 _____

The following pages contain all pay items for:

ADDISON ATHLETIC CLUB RENOVATIONS
PROPOSAL NUMBER 21-125

Bid Submission - Core Updates			**Bid Submission Core Updates**
Project:	Addison Athletic Club Renovations 3900 Beltway Drive Addison, TX 75001	**Contractor:**	**Name:** Northridge Construction Group **Address:** 6904 NE Loop 820 North Richland Hills, Tx 76180
Project SF:	52,575 SF		**Contact:** Matt Tucker
Plans Dated:	6/11/21		
Addendums:	1,2,3		

CSI	Description	Core Updates	Notes
Division 1	General Requirements	$ 135,841	
Division 2	Existing Conditions	$ 9,900	
Division 6	Rough Carpentry	$ 11,061	Includes: All rough carpentry @ RM 210 & 211
Division 8	Openings	$ 15,658	Includes: Doors 103, 107, 108, 109, 110A, 210, 211, 212
Division 9	Finishes	$ 101,725	Includes: - All interior flooring & paint (excluding Locker Room Scope) - Ceiling Baffles @ Reception 104 - Acoustical Wall Panels @ RM 142 - Wood Paneling - 40% of total Wall/Ceiling Paint - All paint in RM 143
Division 10	Specialties	$ 36,784	Includes: All room, wayfinding, and graphics signage
Division 12	Furnishings	$ 10,350	Includes: - All millwork, cabinetry, countertops @ Reception 104
Division 26	Electrical	$ 66,534	Includes: 25% of all - Electrical Demo & Light Fixtures
	Furniture Allowance	$ 140,000	
	Total Bid - Core Updates	**$ 527,852**	

Bid Submission
Bond Improvements

Project:	Addison Athletic Club Renovations 3900 Beltway Drive Addison, TX 75001	**Contractor:**	**Name:** Northridge Construction Group **Address:** 6904 NE Loop 820 North Richland Hills, Tx 76180
Project SF:	52,575 SF		**Contact:** Matt Tucker
Plans Dated:	6/11/21		
Addendums:	1,2,3		

CSI	Description	Unit Costs	Improvement Funds	Notes
Division 1	General Requirements	$	$ 543,363	
Division 2	Existing Conditions	$	$ 39,600	
Division 3	Concrete	$	$ 100,478	
Division 4	Masonry	$	$ 52,500	
Division 5	Metals	$	$ 85,644	
Division 6	Wood & Plastics	$	$ 44,244	
Division 7	Thermal & Moisture Protection	$	$ 465,499	
Division 8	Openings	$	$ 62,630	
Division 9	Finishes	$	$ 406,900	
Division 10	Specialties	$	$ 147,136	
Division 11	Equipment & Appliances	$	$ 19,149	
Division 12	Furnishings	$	$ 41,400	
Division 13	Special Construction	$	$ 320,574	
Division 14	Conveying Systems	$	$ -	
Division 21	Fire Protection	$	$ 40,815	
Division 22	Plumbing	$	$ 274,221	
Division 23	HVAC	$	$ 610,478	
Division 26	Electrical	$	$ 199,601	
Division 27	Communications	$	$ -	
Division 28	Electronic Safety & Security	$	$ 53,000	
Division 31	Earthwork	$	$ -	
Division 32	Exterior Improvements	$	$ -	
Division 33	Utilities	$	$ -	
	Total Bid - Bond Improvements		**$ 3,507,231**	
Alternate - D	AT COMMUNITY ROOM (142) REMOVE AND REPLACE EXISTING 26'-0" LINEAR FEET OF UPPER AND LOWER CABINETS WITH NEW THERMOFOIL RAISED PANEL CASEWORK IN SHAKER STYLE. COLOR: TBD. PROVIDE NEW SOLID SURFACE COUNTERTOP AND (2) REPLACEMENT STAINLESS STEEL SINKS WITH FAUCETS.		$ 26,200	
Alternate - E	EXISTING CAB FINISHES TO BE REMOVED. REPLACE CAB FLOORING WITH NEW TO MATCH ADJACENT TILE FINISH. REPLACE CAB VERTICAL WALL PANELS WITH NEW PLASTIC LAMINATE TO MATCH ADJACENT LOBBY WOOD FINISH. REPLACE CAB CEILING WITH WHITE TRANSLUCENT LENS. REPLACE CAB LIGHTING WITH LED FIXTURES.		$ 25,000	
Alternate - J	PROVIDE NEW ACT AND GRID AT ALL SPACES WITH EXISTING ACT AND RE-INSTALL EXISTING LIGHTING U.O.N. IN LIEU OF BASE BID. (BASE BID: CAREFULLY REMOVE AND RE-INSTALL 25% OF EXISTING ACT, GRID AND LIGHTING FOR MECHANICAL SCOPE, RE: MECHANICAL.		$ 84,100	
Alternate - Q	NATATORIUM NORTH WALL GRAPHIC. SEE PLAN AND ELEVATIONS.		$ 8,100	
Alternate - R	PROVIDE IMPACT RESISTANT DRYWALL CEILINGS IN LIEU OF LAMINATED PANEL CEILINGS AT RACQUETBALL COURTS (136) (137) AND FLEXIBLE FITNESS (138) (139).		$ 65,000	
Alternate - S	AT GYMNASIUM 143, PROVIDE NEW PAINT 'P1' AT EXISTING CEILING DECK AND PREVIOUSLY PAINTED STRUCTURE AND DUCTWORK. PROTECT IN PLACE NON-PAINTABLE ITEMS, LIGHTING AND SPEAKERS. CLEAN DUST FROM VENTS AND CEILING MOUNTED FIXTURES.		$ 19,200	
Alternate - T	AT ATRIUM, PROVIDE NEW PAINT 'P1' AT EXISTING GYP. BOARD CEILING. CLEAN DUST FROM VENTS AND CEILING MOUNTED FIXTURES		$ 24,000	
Alternate - U	REPLACE FORTY (40) PANES IN EXISTING RETRACTABLE SKYLIGHT WITH MINIMUM 10MM TRANSPARENT OR TRANSLUCENT POLYCARBONATE SHEETS. RESEAL AND REPLACE TRIM. BASIS OF DESIGN - SUNLITE MULTIWALL TRANSPARENT OR TRANSLUCENT POLYCARBONATE SHEETS.		$ 23,100	

NOTES: 1. All items, labor, materials, equipment, facilities, incidentals and work required for construction of the project are to be provided and installed by the Contractor as part of the project and payment forthe cost of such shall be included in the price proposed for the construction of the project.

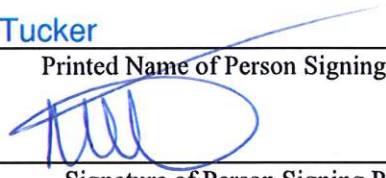
2. Prices must be shown for each item listed in the Proposal. In the event of discrepancy between the unit price and extension, the unit price shall control.

3. Materials, which are "tax exempt", are those items which are physically incorporated into the facilities constructed for the Town of Addison, as set forth in the Special Provisions. Materials include, but are not limited to purchased items such as water pipe, sanitary sewer pipe, storm drain pipe, etc.

   Services, which are "not tax exempt", are those items which are used by the Contractor but are not physically incorporated into the Town of Addison's facility and/or items which are consumed by construction, as set forth in the Special Provisions. Services include, but are not limited to, items such as supplies, tools, skill and labor, the purchase, rental or lease of equipment, etc.

Matt Tucker

Printed Name of Person Signing Proposal



Signature of Person Signing Proposal

6904 NE Loop 820
North Richland Hills, Texas 76180

Address of Business Submitting Proposal

(817) 520-2300 MTucker@NorthridgeCG.com

Telephone No. E-mail Address

81-1768293

T.I.N. (Tax Identification or Employer's Number)

If Offeror is:

AN INDIVIDUAL

By _____ (Seal)
(Individual's Name)

doing business as _____

Business address: _____

_____

_____

Phone No. _____

~~**A PARTNERSHIP**~~ Limited Liability Corporation S-corp

By Northridge Construction Group, LLC (Seal)
(Firm Name)

Matt Tucker
(General Partner)

doing business as _____

Business address: 6904 NE Loop 820

North Richland Hills, Texas 76180

_____

Phone No. (817) 520-2300

A CORPORATION

By _____
(Corporation Name)

_____
(State of Incorporation)

By _____
(Name of Person Authorized to Sign)

_____
(Title)

(Corporate Seal)

Attest _____
(Secretary)

Business address: _____

_____

_____

Phone No. _____

A JOINT VENTURE

By _____
(Name)

_____
(Address)

By _____
(Name)

_____
(Address)

(Each joint venture must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above.)

SECTION BB

BID BOND

BID BOND

Bidder shall submit a bid bond equal to five percent (5%) of the bid price. Failure to submit a bid bond when required may deem the bid non-responsive. Bid Bonds may be submitted electronically with the executed original provided immediately upon request.

Bid Bond

Surety Department

KNOW ALL MEN BY THESE PRESENTS,

That we, **Northridge Construction Group, LLC**, as Principal, hereinafter called the Principal, and the **Argonaut Insurance Company**, a Corporation created and existing under the laws of the State of **Illinois** whose principal office is in County of Cook, Illinois, as Surety, hereinafter called the Surety, are held and firmly bound unto the **Town of Addison, Texas**, as Obligee, hereinafter called the Obligee, in the sum of **Five Percent (5%) of the amount bid--------** Dollars ($ ---------), for the payment of which sum, well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Whereas, the Principal has submitted a bid for

Parks and Recreation Department Proposal 22-010, Addison Athletic Club Renovations

NOW THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or contract documents with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this **19th** day of **August**, A.D. 20**21**.

Witness:

Northridge Construction Group, LLC
(Principal)

By: _____ By _____ (SEAL)

Witness:

Argonaut Insurance Company

Brandi Heath

By _____
Steven Tucker, Attorney-in-Fact (SEAL)

Form S-3266-4 Printed in U.S.A. 12-70

Argonaut Insurance Company
Deliveries Only: 225 W. Washington, 24th Floor
Chicago, IL 60606
United States Postal Service: P.O. Box 469011, San Antonio, TX 78246

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the Argonaut Insurance Company, a Corporation duly organized and existing under the laws of the State of Illinois and having its principal office in the County of Cook, Illinois does hereby nominate, constitute and appoint:

Bennett Brown, W. Lawrence Brown, Kevin J. Dunn, Tanner Langston, Steven Tucker, Tracy Tucker

Their true and lawful agent(s) and attorney(s)-in-fact, each in their separate capacity if more than one is named above, to make, execute, seal and deliver for and on its behalf as surety, and as its act and deed any and all bonds, contracts, agreements of indemnity and other undertakings in suretyship provided, however, that the penal sum of any one such instrument executed hereunder shall not exceed the sum of:

$85,000,000.00

This Power of Attorney is granted and is signed and sealed under and by the authority of the following Resolution adopted by the Board of Directors of Argonaut Insurance Company:

"RESOLVED, That the President, Senior Vice President, Vice President, Assistant Vice President, Secretary, Treasurer and each of them hereby is authorized to execute powers of attorney, and such authority can be executed by use of facsimile signature, which may be attested or acknowledged by any officer or attorney, of the Company, qualifying the attorney or attorneys named in the given power of attorney, to execute in behalf of, and acknowledge as the act and deed of the Argonaut Insurance Company, all bond undertakings and contracts of suretyship, and to affix the corporate seal thereto."

IN WITNESS WHEREOF, Argonaut Insurance Company has caused its official seal to be hereunto affixed and these presents to be signed by its duly authorized officer on the 8th day of May, 2017.

ARGONAUT INSURANCE COMPANY CORPORATE SEAL 1948 ILLINOIS

Argonaut Insurance Company

by: _____

Joshua C. Betz , Senior Vice President

STATE OF TEXAS
COUNTY OF HARRIS SS:

On this 8th day of May, 2017 A.D., before me, a Notary Public of the State of Texas, in and for the County of Harris, duly commissioned and qualified, came THE ABOVE OFFICER OF THE COMPANY, to me personally known to be the individual and officer described in, and who executed the preceding instrument, and he acknowledged the execution of same, and being by me duly sworn, deposed and said that he is the officer of the said Company aforesaid, and that the seal affixed to the preceding instrument is the Corporate Seal of said Company, and the said Corporate Seal and his signature as officer were duly affixed and subscribed to the said instrument by the authority and direction of the said corporation, and that Resolution adopted by the Board of Directors of said Company, referred to in the preceding instrument is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand, and affixed my Official Seal at the County of Harris, the day and year first above written.

KATHLEEN M. MEEKS
Notary Public, State of Texas
Comm. Expires 07-15-2021
Notary ID 557902-8

Kathleen M. Meeks

(Notary Public)

I, the undersigned Officer of the Argonaut Insurance Company, Illinois Corporation, do hereby certify that the original POWER OF ATTORNEY of which the foregoing is a full, true and correct copy is still in full force and effect and has not been revoked.

IN WITNESS WHEREOF, I have hereunto set my hand, and affixed the Seal of said Company, on the 19th day of August, 2021.

ARGONAUT INSURANCE COMPANY CORPORATE SEAL 1948 ILLINOIS

_____

James Bluzard , Vice President-Surety

THIS DOCUMENT IS NOT VALID UNLESS THE WORDS ARGO POWER OF ATTORNEY ARE IN BLUE. IF YOU HAVE QUESTIONS ON AUTHENTICITY OF THIS DOCUMENT CALL (210) 321 - 8400.

SECTION IF

INFORMATION and INSTRUCTION FORM

Information and Instruction Form

RESPONSES THAT DO NOT CONTAIN THIS COMPLETED FORM MAY NOT BE COMPLIANT

Section I Company Profile

Name of Business: Northridge Construction Group, LLC

Business Address: 6904 NE Loop 820, North Richland Hills, Texas 76180

Contact Name: Matt Tucker

Phone#: (817) 520-2300

Fax#: (817) 520-2301

Email: MTucker@NorthridgeCG.com

Name(s) Title of Authorized Company Officers:

Matt Tucker

Federal ID #: W-9 Form: A W-9 form will be required from the successful bidder.

81-1768293

DUN #:

05-913-6987

Remit Address: If different than your physical address:

Section II Instructions to Bidders

Electronic Bids: The Town of Addison uses BidSync to distribute and receive bids and proposals. There will be **NO COST** to the Contractor/Supplier for Standard bids or proposals. For **Cooperative Bids and Reverse Auctions ONLY**, the successful contractor/supplier agrees to pay BidSync a transaction fee of one percent (1%) of the total amount of all contracts for goods and/or services. **Cooperative Bids and Reverse Auctions** will be clearly marked on the bid documents. To assure that all contractors/suppliers are treated fairly, the fee will be payable whether the bid/proposal is submitted electronically, or by paper means. Refer to www.bidsync.com for further information.

Contractor/Supplier Responsibility: It is the contractor/suppliers responsibility to check for any addenda or questions and answers that might have been issued before bid closing date and time. Contractors/Suppliers will be

notified of any addenda and Q&A if they are on the invited list, they view the bid, or add themselves to the watch list.

Acknowledgement of Addenda: #1 #2 #3 #4 #5

Delivery of Bids: For delivery of paper bids our physical address is:

Town of Addison

5350 Beltline Road

Dallas, TX 75254

Attn: Purchasing Department

Contractor/Supplier Employees: No Contractor/Supplier employee shall have a direct or indirect financial interest in any contract with the town, or be directly or indirectly financially interested in the sale of land, materials, supplies or services to the town.

Deliveries: All deliveries will be F.O.B. Town of Addison. All Transportation Charges paid by the contractor/supplier to Destination.

Payment Terms: A Prompt Payment Discount of % is offered for Payment Made Within Days of Acceptance of Goods or Services. If Prompt Payments are not offered or accepted, payments shall be made 30 days after receipt and acceptance of goods or services or after the date of receipt of the invoice whichever is later.

Delivery Dates: Delivery Dates are to be specified in Calendar Days from the Date of Order.

Bid Prices: Pre-Award bid prices shall remain Firm and Irrevocable for a Period of 60 Days.

☐ Exceptions: Contractor/Supplier does not take Exception to Bid Specifications or Other Requirements of this Solicitation. If neither exceptions box is checked, default shall be "No Exceptions"

☐ Contractor/Supplier take the following Exception(s) to the Bid Specifications or Other Requirements of this Solicitation (Explain in Detail). If box checked but no exceptions are listed, default shall be "No Exceptions"

Historically Underutilized Business (HUB): It is the policy of the Town of Addison to involve HUBs in the procurement of goods, equipment, services and construction projects. Prime Contractors/Suppliers are encouraged to provide HUBs the opportunity to compete for sub-contracting and other procurement opportunities. A listing of HUBs in this area may be accessed at the following State of Texas Website.
http://www.window.state.tx.us/procurement/cmbl/cmblhub.html.

HUB Owned Business Yes No Include a current copy of your HUB certification with your response or insert Certification number _____ and expire date _____.

No

Other Government Entities: Would bidder be willing to allow other local governmental entities to participate in this contract, if awarded under the same Terms and Conditions? Yes X No ☐

Bid Bond: Is Bid Bond attached if applicable? XYes ☐No

Termination: The town at any time after issuance of this agreement, by 30 days written notice, has the absolute right to terminate this agreement for cause or convenience. Cause shall be the contractor/supplier's refusal or failure to satisfactorily perform or complete the work within the time specified, or failure to meet the specifications, quantities, quality and/or other requirements specified in the contract/purchase order. In such case the supplier shall be liable for any damages suffered by the town. If the agreement is terminated for convenience, the supplier has no further obligation under the agreement. Payment shall be made to cover the cost of material and work in process or "consigned" to the town as of the effective date of the termination.

Bidder Compliance: Bidder agrees to comply with all conditions contained in this Information and Instruction Form and the additional terms and conditions and specifications included in this request. The undersigned hereby agrees to furnish and deliver the articles or services as specified at the prices and terms herein stated and in strict accordance with the specifications and conditions, all of which are made a part of your offer. Your offer is not subject to withdrawal after the award is made.

The Town of Addison reserves the right to reject all or part of the offer and to accept the offer considered most advantageous to the town by item or total bid.

The Town of Addison will award to the lowest responsible bidder or to the bidder who provides goods or services at the best value for the Town.

I hereby certify that all of the information provided in sections I and II are true and accurate to the best of my knowledge.

Signature: Date: 08/19/2021

Title: President

Signature certifies no changes have been made to the content of this solicitation as provided by the Town of Addison.
10/17/17

SECTION OQS

OFFEROR QUALIFICATION STATEMENT

SECTION OQS

ALL OFFERORS ARE NOTIFIED THAT THE FOLLOWING QUALIFICATION STATEMENT MUST BE COMPLETED AND SUBMITTED WITH THE PROPOSAL

CONTRACTOR'S QUALIFICATIONS

The Contractor shall submit previous projects that show that they have experience with projects of similar size and scope as this project. The projects will include locker room, building, roof, HVAC and pool renovations to a municipal athletic facility. The facility will remain in service and open to members Monday – Sunday from 5:30 am to 10:00 pm. This will require the Contractor to plan his work effortsand equipment needs with these limitations in mind. The Contractor shall submit a complete list of similar Municipal and Non-Municipal current and completed projects of similar size andscope for at least the past five (5) years.

Each Project submitted must provide all the following information in the order listed below:

Project Description: Details provided need to show that the project was similar in size and scope to this project.
Contract NTP Date:
Current or Completed Project:
Project Owner Information: Owner Name, Owners Representative, e-mail address and phone number.
Project Bid/Proposal Value:
Final Project Value:
Contract Time Allowed:
Contract Time Utilized:
Any Litigation Issues? Explain:
Any Verified Safety Violations? Explain:

See attached documents

OFFERORS INFORMATION AND QUALIFICATION STATEMENT

PARKS AND RECREATION PROPOSAL NUMBER 21-125,
ADDISON ATHLETIC CLUB RENOVATION PROJECT

Contractor: Northridge Construction Group, LLC

Indicate One:_____Sole Proprietor _____Partnership LLC Other

_____Corporation _____Joint Venture

Name: Matt Tucker Partner:_____

Title: President Title:_____

Address: 6904 NE Loop 820 Address:_____

City: North Richland Hills City:_____

State & Zip: Texas, 76180 State & Zip:_____

Phone: (817) 520-2300 Phone:_____

State and Date of Incorporation, Partnership, Ownership, Etc. Texas, March 10, 2016

Location of Principal Office: 6904 NE Loop 820, North Richland Hills, TX 76180

Contact and Phone at Principal Office: Matt Tucker, (817) 520-2300

Liability Insurance Provider and Limits of Coverage: Amerisure Insurance, $1,000,000.00

Workers Compensation Insurance Provider: Amerisure Insurance

Surety (Performance and Payment): Argonaut Insurance Company

Address: 685 John B. Sias Memorial Pkwy, Suite 215, Fort Worth, Texas 76134

Contact and Phone: Steven Tucker, (817) 336-76111

Project Manager and Backup Project Manager: (Work Resume - attach additional sheets.) The Project Manager shall be able to communicate in English and shall not operate any equipment on a routine basis. A job site shall be shut down if proper supervision is not provided.

See Tab 06 Proposed Project Team for Resumes

Project Manager Name | Backup Project Manager Name

Aubrey Allen | Alesha Miller

Type(s) of work to be done by Offeror's Employees

General Contracting

Number of Years in Business as a Contractor on Above Types of Works: 5

Type(s) of Work to be done by Sub-Contractors

Include Name, Address, and Phone Number of Sub-Contractor.
Use additional sheets if needed.

Type of Work	Sub-Contractor	Value of Work
See attached document, **Separate from proposal but on USB drive		

REFERENCES

(Use a separate sheet if needed)

Trade references (List Company, Address, Contact Person, Phone and E-mail Address):

See attached document

Bank References (List Institution, Address, Contact Person, Phone and E-mail Address)

See attached document

CLAIMS AND SUITS

(If the answer to any of the following questions is yes, please attach details)

1. Has your organization ever failed to complete any work awarded to it? No

2. Are there any judgments, claims, arbitration proceedings, or suits pending or outstanding against your organization or officers? No

3. Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five (5) years? No

4. Within the last five (5) years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? No

AFFIDAVIT

I, Matt Tucker, being duly sworn deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Date this 19th day of August, 2021.

Name of Organization: Northridge Construction Group, LLC

By Signature: _____

Printed Name: Matt Tucker

Title: President

STATE OF TEXAS

COUNTY OF DALLAS

BEFORE ME the undersigned authority, on this day personally appeared _____ Matt Tucker, known to me to be the person whose name subscribed to the foregoing instrument, and acknowledged to me that he executed the same for the purposes and considerations therein expressed.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this 19th day of August, 2021.

_____

Notary Public in and for Tarrant County, Texas

NOTARY PUBLIC STATE OF TEXAS
Alesha Miller
My Commission Expires
04/08/2022
ID No. 11326086

CURRENT & COMPLETED PROJECTS

Fort Worth ISD Paschal High School Gymnasium

Project Description:

New Phase 3 and Phase 4 Interior construction to complete a newly built shell building for the High School Competition Gym and Field House that has been partially constructed. Phase 3 includes a full competition gym, lobby and public space, concession area, elevator, restrooms, and egress stairs. Phase 4 includes coaches offices and locker rooms, multi-purpose rooms and team meeting rooms on an existing second floor mezzanine structure. Also included is work for minor exterior site drainage and paving improvements along with work for the installation of new HVAC condensers.

Contract NTP Date:

05/23/2018

Current or Completed Project:

Completed

Project Owner Information:

Randy Cofer -- FWISD – (817) 317-7719 – Randall.cofer@fwisd.org

Project Bid/Proposal Value:

$2,784,450.00

Final Project Value:

$2,784,450.00

Contract Time Allowed:

5 Months

Contract Time Utilized:

All Time Used

Any Litigation Issues? Explain:

No

Any Verified Safety Violations? Explain:

No

CURRENT & COMPLETED PROJECTS

Dallas ISD Chapel Hill Preparatory Renovation

Project Description:

Interior and exterior renovations as well as the removal of asbestos-containing materials (ACM). Renovations comprised of roofing renovations, window replacement, exterior and interior painting, mechanical upgrades, and site paving replacement.

Contract NTP Date:

06/01/2020

Current or Completed Project:

Completed

Project Owner Information:

Doug Wallace – DISD -- (972) 925-7304 – C273@dallasisd.org

Project Bid/Proposal Value:

$6,891,150.00

Final Project Value:

$6,885,282.00

Contract Time Allowed:

230 Days

Contract Time Utilized:

All Time Used, ***additional time added for owner approved change orders*

Any Litigation Issues? Explain:

No

Any Verified Safety Violations? Explain:

No

CURRENT & COMPLETED PROJECTS

Waco ISD Paul Tyson Field Replacement

Project Description:

Addition and renovation on the existing Waco High School Campus. Construction of a new athletic track and field facility on the north side of the campus, including a 2,000 seat grandstands, and an approximately 3,000 sq. ft. ticketing/concessions/restroom building. Light renovation of two existing locker rooms on campus primarily to increase locker capacity. New baseball and softball practice field with basic practice amenities.

Contract NTP Date:

03/05/2021

Current or Completed Project:

Current

Project Owner Information:

Alexander Villanueva – WISD – (254) 752-3497 – Alexander.villanueva@wacoisd.org

Project Bid/Proposal Value:

$8,955,000.00

Final Project Value:

N/A, Current Project

Contract Time Allowed:

8 Months

Contract Time Utilized:

N/A, Current Project

Any Litigation Issues? Explain:

No

Any Verified Safety Violations? Explain:

No

CURRENT & COMPLETED PROJECTS

City of Dallas – Bachman Recreational Center

Project Description:

Renovation of recreational center which included: new bathrooms, new flooring, paint, kitchen area, exterior deck, glass entry, and canopy.

Contract NTP Date:

01/10/2020

Current or Completed Project:

Completed

Project Owner Information:

Mahbuba Khan – City of Dallas – (214) 670-4241 – Mahbuba.khan@dallascityhall.com

Project Bid/Proposal Value:

$2,184,500.00

Final Project Value:

$2,320,867.00 ***greater due to owner approved change orders*

Contract Time Allowed:

111 Days

Contract Time Utilized:

All Time Used, ***additional time added for owner approved change orders*

Any Litigation Issues? Explain:

No

Any Verified Safety Violations? Explain:

No

CURRENT & COMPLETED PROJECTS

Tom Bean ISD Miscellaneous Athletic Improvements

Project Description:

Construction of new restrooms, ticket sales and concessions for the existing Tom Bean ISD Stadium. Masonry construction, Avadek type canopies, concrete flat work, stainless steel kitchen counters and sinks, mechanical screening, TPO roofing and digital display units.

Contract NTP Date:

05/01/2021

Current or Completed Project:

Current

Project Owner Information:

Kelly Lusk – TBISD – (903) 546-6076 – Kelly.lusk@tombean-isd.org

Project Bid/Proposal Value:

$3,888,647.00

Final Project Value:

N/A, Current Project

Contract Time Allowed:

7 Months

Contract Time Utilized:

N/A, Current Project

Any Litigation Issues? Explain:

No

Any Verified Safety Violations? Explain:

No

REFERENCES

Trade References

1. Summit Consultants

   1300 Summit Ave, Ste 500

   Fort Worth, TX 76102

   Brian Richards

   (817) 690-1117

   Bdr@summitmep.com

2. th+a architects

   1506 Griffin Street West

   Dallas, TX 75215

   Matthew Heaton

   (214) 466-2778

   Mheaton@thaarch.com

3. Cocanougher Asset

   6851 NE Loop 820, Ste 200

   North Richland Hills, TX 76180

   Jacque Burris

   (817) 577-1131

   Jacque@wiseadv.com

Bank References

1. Origin Bank

   500 Throckmorton Street, Ste 350

   Fort Worth, TX 76102

   Eric Reed

   (817) 550-7460

   Ereed@origin.bank

SECTION CA

CONTRACT AGREEMENT

CONTRACT AGREEMENT

STATE OF TEXAS

COUNTY OF DALLAS

THIS AGREEMENT is made and entered into this **12th** day of **October,** 2021, by and between the **Town of Addison**, of the County of Dallas and State of Texas, acting through its City Manager, thereunto duly authorized so to do, Party of the First Part, hereinafter termed the OWNER, and **Northridge Construction Group, LLC**, of the City of North Richland Hills, County of Tarrant, State of Texas, Party of the Second Part, hereinafter termed CONTRACTOR.

WITNESSETH: That for and in consideration of the payment and agreement hereinafter mentioned, to be made and performed by the OWNER, the said CONTRACTOR hereby agrees with the said OWNER to commence and complete construction of certain improvements as follows:

ADDISON ATHLETIC CLUB RENOVATIONS

PARKS AND RECREATION DEPARTMENT PROPOSAL NUMBER 21-125

and all extra work in connection therewith, under the terms as stated in the Contract Documents; and at their own proper cost and expense to furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance and other accessories and services necessary to complete the said construction, in accordance with the conditions and prices stated in the Proposal attached hereto and in accordance with the Contract Documents.

The Contract Documents shall consist of the following documents:

1. this Contract Agreement;
2. properly authorized change orders;
3. any listed and numbered addenda;
4. the Special Provisions;
5. Technical Specifications & Project Drawings;
6. the Instructions to Offerors and Terms and Conditions contained in the OWNER's Proposal;
6. the OWNER's Standard Construction Details;
7. the October 2017 5th Edition of the Public Works Construction Standards - North Central Texas as amended and published by the North Central Texas Council of Governments, as amended by the Owner (collectively, the "NCTCOG Specifications ");
8. the OWNER's written notice to proceed to the CONTRACTOR;
9. the Contractor's Bid Proposal (response);
10. the Performance, Payment, and Maintenance Bonds; and,
11. any other bid materials distributed by the Owner that relate to the Project.

These Contract Documents are incorporated by reference into this Contract Agreement as if set out here in their entirety. The Contract Documents are intended to be complementary; what is called for by one

document shall be as binding as if called for by all Contract Documents. However, notwithstanding Section (Y) of the Instructions to Offerors contained in the OWNER's Proposal, it is specifically provided herein that in the event of any inconsistency in the Contract Documents, the inconsistency shall be resolved by giving precedence to the Contract Documents in the order in which they are listed herein above. If, however, there exists a conflict or inconsistency between the Technical Specifications and the Project Drawings it shall be the CONTRACTOR's obligation to seek clarification as to which requirements or provisions control before undertaking any work on that component of the project. Should the CONTRACTOR fail or refuse to seek a clarification of such conflicting or inconsistent requirements or provisions prior to any work on that component of the project, the CONTRACTOR shall be solely responsible for the costs and expenses - including additional time - necessary to cure, repair and/or correct that component of the project.

The CONTRACTOR hereby agrees to commence work within ten (10) working days after the date of written Notice to Proceed so shall have been given to them, to Substantially Complete the work within **One Hundred Ninety Five** (**195**) calendar days, after work commences, subject to such extensions of time as are approved as provided by the Contract Documents. The CONTRACTOR agrees to fulfill the intent of the plans and specifications associated with Proposal #21-125.

The OWNER agrees to pay the CONTRACTOR **Four Million, Thirty-Five Thousand and Eighty Three Dollars ($4,035,083)** for improvements in current funds for the performance of the Contract in accordance with the Contract Documents, and to make payments of account thereof as provided therein. At its sole discretion, OWNER may also request CONTRACTOR to complete the Alternate Bid Items identified in the Bid in the Amount of **Two Hundred Seventy-Four Thousand Seven Hundred Dollars ($274,700)** all payable from current funds for the performance of the Contract in accordance with the Proposal submitted thereof, subject to properly authorized additions and deductions, and to make payments of account thereof as provided in the Contract Documents.

[Signature page follows]

IN WITNESS WHEREOF, the parties of these presents have executed this AGREEMENT in the year and day first above written.

TOWN OF ADDISON, TEXAS (OWNER)

By: _____
Wes Pierson, City Manager

ATTEST:

By: _____
Irma Parker, City Secretary

NORTHRIDGE CONSTRUCTION GROUP, LLC
(CONTRACTOR)

By: _____

Name: Matt Tucker

Title: President

ATTEST:

By: _____

Name: _____

Title: _____

The following to be executed if the CONTRACTOR is a corporation:

I, _____ _____ certify that I am the secretary of the corporation named as CONTRACTOR herein; that _____ _____ _____, who signed this Contract on behalf of the CONTRACTOR is the _____ (official title) of said corporation; that said Contract was duly signed for and in behalf of said corporation by authority of its governing body, and is within the scope of its corporate powers.

Signed: _____

Corporate Seal

IN WITNESS WHEREOF, the parties of these presents have executed this AGREEMENT in the year and day first above written.

TOWN OF ADDISON, TEXAS (OWNER)

By:_____

Wes Pierson, City Manager

_____

Printed Name

ATTEST:

By: _____

Irma Parker, City Secretary

_____

Printed Name

Northridge Construction Group, LLL
(CONTRACTOR)

By:_____

_____

Printed Name

ATTEST:

By: _____

_____

Printed Name

The following to be executed if the CONTRACTOR is a corporation:

I,_____certify that I am the secretary of the corporation named as CONTRACTOR herein; that_____, who signed this Contract on behalf of the CONTRACTOR is the_____(official title) of said corporation; that said Contract was duly signed for and in behalf of said corporation by authority of its governing body, and is within the scope of its corporate powers.

Signed: _____

Corporate Seal

SECTION PrB

PERFORMANCE BOND

PERFORMANCE BOND

STATE OF TEXAS }
COUNTY OF DALLAS }

WHEREAS,_____as principal ("Contractor") and _____, a corporation organized under the laws of _____and being duly authorized to do business in the State of Texas, as surety ("Surety")(whether one or more), do hereby expressly acknowledge themselves to he held and bound to pay to the Town of Addison, Texas, a home-rule municipality organized and operating under the Constitution and laws of the State of Texas (the "Town"), its successors and assigns, and to all persons, firms, subcontractors and corporations who may furnish materials or labor under the contract as more fully described below, the sum of_____Dollars in the lawful currency of the United States of America ($) for the payment of which Contractor and Surety are liable to the Town, jointly and severally; and

WHEREAS, Contractor has this day entered into a written contract with the Town to build and construct Addison Athletic Club Renovations
which contract and the plans and specifications therein mentioned (collectively referred to hereinafter as the "Contract") are hereby expressly incorporated into and made a part hereof as though set forth at length; and

WHEREAS, this bond is given pursuant to Chapter 2253 of the Texas Government Code;

NOW, THEREFORE, if Contractor shall well, truly and faithfully perform all of the undertakings, duties, terms, conditions and agreements of the Contract; shall satisfy all claims and demands incurred under the Contract; shall fully indemnify and hold the Town harmless; shall reimburse and repay the Town for any outlay or expense which the Town may incur in making good any default, and shall promptly make payment to all persons, firms, subcontractors and corporations who may furnish materials or labor under the Contract, then this obligation shall be void; otherwise to remain in full force and effect. The obligations of Contractor and Surety under this bond apply both to the original Contract and to any extension or modification of the Contract and Surety agrees that no change, extension of time, addition, expansion or other modification of the Contract, the work to be done under the Contract, or the plans and specifications which are a part of the Contract shall in any manner affect the obligations of Surety under this bond, and Surety waives notice of any such change, extension of time, addition, expansion or other modification. The obligations of Contractor and Surety under this bond are performable and payable in Dallas County, Texas such that exclusive venue for any legal action pertaining to this bond shall lie in Dallas County, Texas. By their signatures below, the persons signing this bond warrant and represent that they are, respectively, duly authorized to sign on behalf of Contractor and Surety.

EXECUTED this the_____day of_____, 2_____.

CONTRACTOR:	SURETY: [1]
By:_____	By:_____
Printed Name:_____	Printed Name:_____
Title:_____	Title:_____

ACKNOWLEDGMENTS
[Contractor]

STATE OF TEXAS }
COUNTY OF DALLAS }

Before me_____(insert the name of the officer) on this day _____ personally appeared_____known to me (or proved to me on the oath of_____) or through_____(description of identity card or other document) to be the person whose name is subscribed to the forgoing instrument and acknowledged to me that he/she executed the same for the purpose and consideration therein expressed.

Given under my hand and seal of office this_____day of_____, 2_____.

_____ _____
Notary Public in and for the State of Texas Typed or Printed Name of Notary
My Commission Expires:_____

[Surety]

STATE OF TEXAS }
COUNTY OF DALLAS }

This instrument was acknowledged before me on the_____day of_____, 2_____by _____ who is the_____of the Surety, on behalf of Surety.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this the_____day of_____, 2_____.

_____ _____
Notary Public in and for the State of Texas Typed or Printed Name of Notary
My Commission Expires:_____

1 Please see attached contact sheet for Surety and the Texas Department of Insurance.

Payment and Performance Bond Contact Sheet

(1) Claims:

All notices of claims shall be sent to the surety at the following address:

_____
(Name of surety)

_____
(Mailing address)

_____
(Physical address)

_____
(Phone number)

(2) Texas Department of Insurance Contact Number:

The address and contact information of the surety may otherwise be obtained by contacting the Texas Department of Insurance at the following toll-free telephone number:

1-800-252-3439.

SECTION PyB

PAYMENT BOND

PAYMENT BOND

STATE OF TEXAS }
COUNTY OF DALLAS }

WHEREAS,_____, as principal ("Contractor") and _____, a corporation organized under the laws of _____ and being duly authorized to do business in the State of Texas, as surety ("Surety")(whether one or more), do hereby expressly acknowledge themselves to he held and bound to pay to the Town of Addison, Texas, a home-rule municipality organized and operating under the Constitution and laws of the State of Texas (the "Town"), its successors and assigns, and to all persons, firms, subcontractors and corporations who may furnish materials or labor under the contract as more fully described below, the sum of_____Dollars in the lawful currency of the United States of America ($) for the payment of which Contractor and Surety are liable to the Town, jointly and severally; and

WHEREAS, Contractor has this day entered into a written contract with the Town to build and construct _____ Addison Athletic Club Renovations

which contract and the plans and specifications therein mentioned (collectively referred to hereinafter as the "Contract") are hereby expressly incorporated into and made a part hereof as though set forth at length; and

WHEREAS, this bond is given pursuant to Chapter 2253 of the Texas Government Code;

NOW, THEREFORE, if Contractor shall promptly make payment to all persons, firms, subcontractors and corporations who may furnish materials or labor under the Contract, then this obligation shall be void; otherwise to remain in full force and effect. The obligations of Contractor and Surety under this bond apply both to the original Contract and to any extension of time or modification of the Contract and Surety agrees that no change, extension of time, addition, expansion or other modification of the Contract, the work to be done under the Contract, or the plans and specifications which are a part of the Contract shall in any manner affect the obligations of Surety under this bond, and Surety waives notice of any such change, extension of time, addition, expansion or other modification. The obligations of Contractor and Surety under this bond are performable and payable in Dallas County, Texas such that exclusive venue for any legal action pertaining to this bond shall lie in Dallas County, Texas. By their signatures below, the persons signing this bond warrant and represent that they are, respectively, duly authorized to sign on behalf of Contractor and Surety.

EXECUTED this the_____day of_____, 2_____.

CONTRACTOR:	SURETY: 1
By:_____	By:_____
Printed Name:_____	Printed Name:_____
Title:_____	Title:_____

ACKNOWLEDGMENTS
[Contractor]

STATE OF TEXAS }
COUNTY OF DALLAS }

Before me_____(insert the name of the officer) on this day_____personally appeared _____known to me (or proved to me on the oath of_____) or through_____(description of identity card or other document) to be the person whose name is subscribed to the forgoing instrument and acknowledged to me that he/she executed the same for the purpose and consideration therein expressed.

Given under my hand and seal of office this_____day of_____, 2_____.

_____ _____
Notary Public in and for the State of Texas Typed or Printed Name of Notary
My Commission Expires:_____

[Surety]

STATE OF TEXAS }
COUNTY OF DALLAS }

This instrument was acknowledged before me on the _____ day of _____, 2_____ by _____who is the_____of the Surety, on behalf of Surety.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this the_____day of_____, 2_____.

_____ _____
Notary Public in and for the State of Texas Typed or Printed Name of Notary
My Commission Expires:_____

1 Please see attached contact sheet for Surety and the Texas Department of Insurance

Payment and Performance Bond Contact Sheet

(1) Claims:

All notices of claims shall be sent to the surety at the following address:

_____
(Name of surety)

_____
(Mailing address)

_____
(Physical address)

_____
(Phone number)

(2) Texas Department of Insurance Contact Number:

The address and contact information of the surety may otherwise be obtained by contacting the Texas Department of Insurance at the following toll-free telephone number:

1-800-252-3439.

SECTION MB

MAINTENANCE BOND

MAINTENANCE BOND – ONE YEAR

STATE OF TEXAS '
COUNTY OF DALLAS '

WHEREAS,_____, as principal ("Contractor") and _____, a corporation organized under the laws of _____and being duly authorized to do business in the State of Texas, as surety ("Surety")(whether one or more), do hereby expressly acknowledge themselves to he held and bound to pay to the Town of Addison, Texas, a home-rule municipality organized and operating under the Constitution and laws of the State of Texas (the "Town"), its successors and assigns the sum of _____ Dollars in the lawful currency of the United States of America ($) for the payment of which Contractor and Surety are liable to the Town, jointly and severally; and

WHEREAS, Contractor has this day entered into a written contract with the Town to build and construct which contract and the plans and specifications therein mentioned (collectively referred to hereinafter as the "Contract") are hereby expressly incorporated into and made a part hereof as though set forth at length; and

WHEREAS, under the Contract it is provided that the Contractor will maintain and keep in good repair all work to be performed and done under the Contract for a period of **one (1) year** from and after its date of final completion and written acceptance by the Town, and to do and perform all necessary work and repair any defective condition, it being understood that the purpose of this maintenance bond is to insure all warranties, express or implied, made or given by the Contractor to the Town and to cover all defective, inadequate or non-conforming conditions arising by reason of any materials or labor installed, provided, constructed or performed by the Contractor and in case the Contractor shall fail to correct any such conditions it is agreed that the Town may make such corrections and charge the cost of making those corrections against the Contractor and the Surety on this obligation, and the Contractor and Surety shall be subject to the liquidated damages provided in the contract, the plans and the specifications for each day's failure on its part to comply with the terms and provisions of the Contract;

NOW, THEREFORE, if the Contractor shall keep and perform its obligation to maintain the work and keep the work in repair for the full maintenance period of one (1) year as herein provided, then these presents shall be null and void and have no further effect, but if default shall be made by Contractor in the performance of its obligations, then these presents shall have full force and effect, and the Town shall have and recover from the Contractor and its Surety damages in the premises as provided and it is further understood and agreed that this obligation shall be a continuing one against the Contractor and the Surety and that successive recoveries may be had hereon for successive breaches until the full amount of this bond shall have been exhausted; and it is further understood that the obligation under this bond to maintain the work shall continue throughout the maintenance period and shall not be changed, diminished, or in any other manneraffected during the term of this bond. The obligations of Contractor and Surety under this bond apply both to the original Contract and to any extension or modification of the Contract and Surety agrees that no change, extension of time, addition, expansion or other modification of the Contract, the work to be done under the Contract, or the plans and specifications which are a part of the Contract shall in any manner affect the obligations of Surety under this bond, and Suretywaives notice of any such change, extension of time, addition, expansion or other modification. The obligations of Contractor and Surety under this bond are performable and payable in Dallas County, Texas such that exclusive venue for any legal action pertaining to this bond shall lie in Dallas County, Texas. By their signatures below, the persons signing this bond warrant and represent that they are, respectively, duly authorized to sign on behalf of Contractor and Surety.

EXECUTED this the_____day of_____, 2_____.

CONTRACTOR:	SURETY:
By:_____	By:_____
Printed Name:_____	Printed Name:_____
Title:_____	Title:_____
Address of Principal:	Address of Surety:
_____	_____
_____	_____
_____	_____

ACKNOWLEDGMENTS
[Contractor]

STATE OF TEXAS '
COUNTY OF DALLAS '

Before me_____(insert the name of the officer) on this day_____personally appeared _____known to me (or proved to me on the oath of_____) or through_____(description of identity card or other document) to be the person whose name is subscribed to the forgoing instrument and acknowledged to me that he/she executed the same for the purpose and consideration therein expressed.

Given under my hand and seal of office this_____day of_____, 2_____.

_____ _____
Notary Public in and for the State of Texas Typed or Printed Name of Notary
My Commission Expires:_____

[Surety]

STATE OF TEXAS '
COUNTY OF DALLAS '

This instrument was acknowledged before me on the_____day of_____, 2_____by_____who is the _____of the Surety, on behalf of Surety.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this the_____day of_____, 2_____.

Notary Public in and for the State of Texas

Typed or Printed Name of Notary

SECTION BP

CONTRACTOR'S AFFIDAVIT OF BILLS PAID

CONTRACTOR'S AFFIDAVIT OF BILLS PAID

STATE OF TEXAS

COUNTY OF DALLAS

Personally, before me the undersigned authority, on this day appeared_____who, being duly sworn, on oath, says that he is a legal representative of _____

(full name of Contractor as in contract)

and that the contract for the construction of the project, designated as

ADDISON ATHLETIC CLUB RENOVATIONS

PARKS AND RECREATION DEPARTMENT PROPOSAL NUMBER 21-125

has been satisfactorily completed and that all bills for materials, apparatus, fixtures, machinery and labor used in connection with the construction of this project have, to the best of my knowledge and belief, been fully paid.

_____

Signature

_____

Printed Name

_____

Title

Sworn to and subscribed before me this_____day of_____, 2021.

_____

Notary Public in and for

_____ County, Texas

Instructions:

If the contractor is an individual, he shall sign the affidavit. If the contractor is a partnership, any partner may sign the affidavit. If the contractor is a corporation, a person authorized by the by-laws or by the Board of Directors shall sign the affidavit. If the Contractor is a joint-venture of individuals, any of the individuals may sign the affidavit. If the Contractor is a joint-venture of partnerships, or of individuals and partnerships, the affidavit may be signed by the individual or any partner of any partnership. If the contractor is a joint-venture in which a corporation is a party, separate affidavits must be executed in the name of the joint-venture: one by each corporation and one by each individual or partnership. Signatures for corporations should be by a duly authorized officer. If signature is by another, a showing of authority to sign must accompany the affidavit.

Interested Parties

In 2015, the Texas Legislature adopted House Bill 1295, which added section 2252.908 of the Government Code. The law states that a governmental entity or state agency may not enter into certain contracts with a business entity unless the business entity submits a disclosure of interested parties to the governmental entity or state agency at the time the business entity submits the signed contract to the governmental entity or state agency. The law applies only to a contract of a governmental entity or state agency that either (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed or (2) has a value of at least $1 million. The disclosure requirement applies to a contract entered into on or after January 1, 2016.

The Texas Ethics Commission was required to adopt rules necessary to implement that law, prescribe the disclosure of interested parties form, and post a copy of the form on the commission's website. The commission adopted the Certificate of Interested Parties form (Form 1295) on October 5, 2015. The commission also adopted new rules (Chapter 46) on November 30, 2015, to implement the law.

Filing Process

On January 1, 2016, the commission made available on its website a new filing application that must be used to file Form 1295. A business entity must use the application to enter the required information on Form 1295 and print a copy of the completed form, which will include a certification of filing that will contain a unique certification number. An authorized agent of the business entity must sign the printed copy of the form and have the form notarized. The completed Form 1295 with the certification of filing must be filed with the governmental body or state agency with which the business entity is entering into the contract.

The governmental entity or state agency must notify the commission, using the commission's filing application, of the receipt of the filed Form 1295 with the certification of filing not later than the 30th day after the date the contract binds all parties to the contract. The commission will post the completed Form 1295 to its website within seven business days after receiving notice from the governmental entity or state agency.

Information regarding how to use the filing application will be available on this site by January 1, 2016. https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm, please follow Instructional Video for Business Entities.

SECTION GP

GENERAL PROVISIONS

GENERAL PROVISIONS

The General Provisions of the Contract shall be as stated in the *Standard Specifications for Public Works Construction – North Central Texas, 5th Edition (2017)*, under Division 100, "General Provisions," Items 101.1 through 110.4 inclusive, as amended or supplemented and except as modified by the Special Provisions or Instructions to Bidders.

SECTION SP

SPECIAL PROVISIONS

SPECIAL PROVISIONS

1. **SCOPE OF WORK:** The Work to be performed under the provisions of these Contract Documents shall consist of furnishing all materials, labor, equipment, supplies and appurtenances; providing all construction, plant, equipment and tools; performing all necessary labor and supervision; and the construction complete, including all Work appurtenant thereto, the proposed improvements for: **ADDISON ATHLETIC CLUB RENOVATION** ("Project").

2. **GENERAL:** This Work shall conform to the requirements of the Specifications and the details as shown in the Contract Documents and referenced specifications. These Contract Documents are intended to be complementary. The Contractor shall do all work as provided in the plans, specifications, special provisions, proposal and contract, and shall do such additional Extra work as may be considered necessary to complete the work in a satisfactory and acceptable manner. The Contractor shall furnish all labor, tools, materials, machinery, equipment, and incidentals necessary to the satisfactory prosecution and completion of the Work. Requirements of any of the Contract Documents are as binding as if called for by all. In the event of conflict between the Plans and the Specifications, the Contractor will be deemed to have assumed the more expensive way of doing the Work unless, before submitting a proposal, the Contractor shall have asked for and obtained (by addendum) a written decision as to which method or material is intended.

3. **EXAMINATION OF SITE:** The Contractor acknowledges that they have investigated and satisfied itself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, or similar physical conditions at the site, conditions of the ground, the character of equipment and facilities needed preliminary to and during prosecution of the Work. The Contractor acknowledges that they have inspected the site of the Work and is familiar with the soil conditions to be encountered. Any failure by the Contractor to acquaint themselves with the available information will not relieve them from responsibility for estimating properly the difficulty or cost of successfully performing the Work. The Town of Addison assumes no responsibility for any conclusions or interpretations made by the Contractor on the basis of the information made available by the Town and the Architect of Record (**LPA Architects, Inc.).**

4. **SPECIFICATIONS:** Construction improvements shall be governed by the following published specifications and details (except as modified by these Special Provisions):

   Standard Specifications for Public Works Construction, North Central Texas - North Central Texas Council of Governments (latest edition); Town of Addison StandardConstruction Details;

   The Contractor shall keep copies of applicable Specifications on the Project site at all times.

   Where reference is made to specifications compiled by other agencies, organizations or departments, such referenced specifications are hereby made a part of the Project Specifications.

5. **SUBSURFACE INVESTIGATION:** Subsurface exploration to ascertain the nature of soils, including the amount of rock, if any, is the responsibility of any and all prospective Offerors. It shall be the responsibility of the Offerors to make such subsurface investigationsas they deem necessary to determine the nature of the material to be encountered. Some preliminary subsurface exploration has been performed by the Town of Addison and the Engineer and is provided to the Contractor in the Contract Documents. This information is provided only as preliminary and all proposals shall be based on information obtained by theContractor. The Town of Addison and the Engineer disclaim any responsibility for the accuracy, true location and extent of the soils information that has been prepared by others. They further disclaim responsibility for interpretation of that data by Offerors, as in projecting soil bearing values, rock profiles, soils stability and the presence, level and extentof underground water.

6. **HISTORICAL, SCIENTIFIC AND ARCHAEOLOGICAL DISCOVERIES:**Contractor shall immediately give an oral and written report to the Town of Addison of the discovery of any articles of historical, scientific, or archaeological significance. Contractor shall take all necessary steps to preserve the article and shall cease operations, which wouldaffect the find until otherwise directed by the Town of Addison but continue with all other unaffected operations. The future operations of Contractor with respect to the discovery, including disposition of the articles, shall be decided by the Town of Addison. The Town ofAddison shall have sole and exclusive title to any discovered articles.

The Town of Addison shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in Contractor's cost of, or the time required for performing any part of the work under the Contract, whether or not changed as a result of conditions, an equitable adjustment will be made and the Contract modified in writing accordingly.

No request by Contractor for an equitable adjustment to the Contract under this Section shall be allowed unless Contractor has given the written notice required. No request by Contractor for an equitable adjustment of the Contract for differing site conditions will be allowed or shall be made after final payment under the Contract.

ENVIRONMENTAL REQUIREMENTS: In addition to requirements set forth in other sections of the Contract, including the Plans and Specifications, Contractor shall ensure that the requirements of this Section are fulfilled and incorporated into its procedures and processes as well as those of any Subcontractors. All materials utilized by Contractor on the Project shall comply with all applicable local, state and federal laws and regulations.

A. Contractor is responsible for compliance with any requirements included in the Contract Documents regarding Hazardous Materials. If Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by Contractor, Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Town of Addison in writing.

1. The term "Hazardous Materials" means any substance or compound, whether solid, liquid or gaseous: (i) which is listed, defined or regulated as a "hazardous substance", "hazardous waste", "extremely hazardous waste", "solid waste", "toxic substance", "hazardous substance", "hazardous material" or "regulated substance" or otherwise classified as hazardous or toxic, in or pursuant to any Environmental Law; or (ii) which is or contains asbestos, radon, any polychlorinated biphenyl, urea formaldehyde foam insulation, explosive or radioactive material, lead, or motor fuel or other volatile organic compounds; or (iii) which causes or poses a threat to cause a contamination or nuisance on the Project Site or any adjacent property, or (iv) which causes or poses a threat to cause a hazard to the environment or to the health, safety or welfare of persons on or about the Project Site.

2. The term "Environmental Law" means any federal, state or local law, statute, guidance or policy statement, ordinance, code, rule, regulation, license, authorization, decision, order, injunction or decree, which pertains to health, safety or the environment (including, but not limited to, ground, air, water or noise pollution or contamination, and underground or aboveground tanks) and shall include without limitation, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, the Resource Conservation and Recovery Act of 1976, as amended, the Occupational Health and Safety Act, the Toxic Substances Control Act, the Texas Water Code and the Texas Solid Waste Disposal Act and any other state or federal environmental statutes.

B. If the material or substance was on the site prior to the issuance of the Notice to Proceed, the Town of Addison shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by Contractor and, in the event such material or substance is found to be present, to verify that it has been remediated to levels required by the Texas Commission on Environmental Quality. When the material or substance has been remediated, Work in the affected area shall resume upon written direction of the Town of Addison.

C. Except as provided in Subparagraph B., Contractor (with the Town of Addison's prior written approval of the laboratory) shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by Contractor and, in the event such material or substance is found to be present, the Town of Addison shall determine whether Contractor or the Town of Addison shall have the substance remediated to levels required by the Texas Commission on Environmental Quality. When the material or substance has been remediated, Work in the affected area shall resume upon written direction of the Town of Addison. The Contract time shall be not be extended and the Contract Price shall not be increased, unless the material or substance to be remediated were not introduced to the Work Site by Contractor, and Contractor shall then pay for (or reimburse the Town of Addison for) the testing and remediation.

D. The Town of Addison shall not be responsible under this Section for materials or substances Contractor brings or introduces to the Project Site. Contractor shall be responsible for the fault or negligence in the use and handling of materials or substances of Contractor, Subcontractor, Sub-subcontractor, or anyone directly or indirectly employed by any of them.

E. Contractor shall indemnify the Town of Addison and its affiliates for any and all damages incurred by the Town of Addison as a result of Contractor's actions with respect to all applicable state and federal environmental laws related to materials or substances Contractor brings to the Project Site, including but not limited to fines, penalties, costs of remediation and reasonable attorney's fees. No time extension shall be granted for breach of this provision.

F. Contractor agrees that it shall not transport to, use, generate, dispose of, or install at the Project Site any Hazardous Materials, except in accordance with applicableenvironmental laws. Further, in performing the Work, Contractor shall not cause any releaseof Hazardous Materials into, or contamination of, the environment, including the soil, the atmosphere, any water course or ground water unless required by the Contract Documents. In the event Contractor engages in any of the activities prohibited in this Section or fails to stop Work as provided in this Section, to the fullest extent permitted by law, Contractor hereby indemnifies and holds the Town of Addison, its affiliates and their respective officers,agents, employees and tenants harmless from and against any and all claims, damages, losses,causes of action, suits and liabilities of every kind, including but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to or resulting from the activities prohibited in this Section or Contractor's failure to stop Work asrequired. Contractor shall obtain from manufacturers and furnish to the Town of Addison Materials Safety Data Sheets (OSHA Form 20) for all materials incorporated into the Projectby Contractor. The Town of Addison hereby agrees that, as between the Town of Addison and Contractor, the Town of Addison will be responsible for Hazardous Materials on site which existed prior to Contractor performing Work on the Project Site or which areintroduced to the Project Site by the Town of Addison, except as provided in this Section. Contractor will not be considered the generator of Hazardous Materials on site which existedprior to Contractor performing Work on the Work Site or which are introduced to the ProjectSite by the Town of Addison. If the Hazardous Materials were on the Project Site prior to Contractor's presence on the Project Site or were introduced to the Project Site by the Townof Addison, then, if appropriate, the Town of Addison will make an equitable adjustment tothe Contract.

G. Include in all construction subcontracts exceeding $100,000, the following requirement: "Contractor is responsible for compliance with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act, Section 505 of the Clean Water Act, Executive Order 11738, and Environmental Protection Agency regulations."

H. No request by Contractor for an equitable adjustment to the Contract under this Section shall be allowed unless Contractor has given the written notice required.

I. No request by Contractor for an equitable adjustment of the Contract for Hazardous Materials will be allowed or shall be made after final payment under the Contract.

7. **<u>COMPLIANCE WITH LAWS</u>:** The Contractor shall familiarize himself with the nature and extent of the Specifications, Plans, Project Site conditions, traffic and safety requirements, and shall fully comply with all local, state and federal laws, including all codes, ordinances, rules and regulations applicable to this Contract and the Work to be done hereunder, which exist or which may be enacted later by governmental bodies having jurisdiction or authority for such enactment. The Contractor shall comply with all federal,

state and local laws, rules and regulations of every kind and nature applicable to the performance of its Work hereunder, and shall hold the Town of Addison and the Architect harmless therefrom. No plea of ignorance or misunderstanding thereof will be considered.

8. **PERMITS, LICENSES, AND REGULATIONS:** Permits and licenses for the prosecution of the Work shall be secured and paid for by the Contractor. Any required permit fees will be paid by the Contractor. Wherever the Work under this contract requires the obtaining of permits from the Town of Addison or other public authorities, duplicate copies of such permits shall be furnished to the Architect by the Contractor hereunder before the Work covered thereby is started. **NO WORK WILL BE ALLOWED TO PROCEED BEFORE SUCH PERMITS ARE OBTAINED AND SUBMITTED TO THE TOWN REPRESENTATIVE.**

9. **RESTRICTED WORK HOURS:** Per the Town of Addison Building Regulations, "It shall be unlawful for a person, firm or corporation to excavate, erect, build, construct, alter, repair or demolish any building or structure which has been issued or which is required to be issued a building permit by the Town of Addison between the hours of 7:00 p.m. and 7:00 a.m. Monday through Friday, and between the hours of 7:00 p.m. and 8:00 a.m. on Saturday and Sunday, if such activity is performed within a residential, apartment, or townhouse zoned area, or within three hundred (300) feet of an occupied residence, except in cases of urgent necessity or in the interest of public safety and convenience, and then only by permit of the City Manager." If the contractor needs to preform "nightwork construction", Sunday or Holiday Work they must request and receive approval from the assigned Town staff.

10. **COMPLIANCE WITH IMMIGRATION LAWS:** Contractor shall take all steps necessary to ensure that all of the Contractor's employees are authorized to work in the United States as required by the Immigration Reform and Control Act of 1986.

11. **NON-DISCRIMINATION POLICY:** It is the policy of the Town of Addison to afford all people an equal opportunity to bid on any contract being let by the Town. The Town of Addison has a policy that prohibits discrimination against any person because of race, color, sex, or national origin, in the award or performance of any contract. The Town of Addison will require its employees, agents, and Contractors to adhere to this policy.

12. **ANTITRUST LAWS:** The Contractor hereby assigns to the Town of Addison any and all claims for overcharges associated with this contract which arise under the antitrust laws of the United States 15 U.S.C.A. Sec. 1, et seq. (1973).

13. **ABANDONMENT:** The Town of Addison reserves the right to abandon, without obligation to the Contractor, any part of the Project, or the entire Project, at any time before the Contractor begins any construction Work authorized by the Town of Addison. In case of total abandonment of the Project, the Contract becomes void. The Town of Addison may abandon portions of the Project at any time during the Project duration. In case of such partial abandonment, the Contractor shall not be due any payment for lost or unrealized profits on the abandoned portions of the Project.

14. **DISCREPANCIES:** If the Contractor, in the course of the Work, finds any discrepancy between the Contract Documents and the physical conditions of the Project, or any errors or omissions in Plans or in the layout as given by survey points and instructions, or if it appears

that any Plan, Specification or other Contract Document is or may not be in compliance with any building code or other requirement of any governmental body, they shall immediately inform the Town of Addison and the Engineer in writing, and the Town of Addison and the Engineer shall promptly verify the same. Any Work done after such discovery, until authorized, will be done at the Contractor's risk.

15. **ADDENDA:** Offerors desiring further information, or interpretation of the Plans and Specifications, must make written request for such information to the Engineer not later than four (4) working days prior to the date set for the Proposal Submittal Date. The ability to ask questions will close at **5:00 pm on Wednesday, July 28, 2021. All questions received bythis deadline will be answered by 5:00pm on Monday, August 2, 2021**. Answers to all such requests will be issued in the form of Addenda and a copy of such Addenda will be releasedthrough www.bidsync.com. It will be the responsibility of each person who has been issueda set of Proposal Documents to secure all Addenda from www.bidsync.com. Addenda will be bound with and made a part of the Contract Documents. No other explanation or interpretation will be considered official or binding. Should an Offeror find discrepancies in,or omissions from, the Plans, Specifications or Contract Documents, or should it be in doubtas to their meaning, it shall at once notify the Engineer in writing in order that a written addendum may be sent to all Offerors.

16. **PAY ITEMS:** Pay items provided are intended to be all-inclusive of the Work required on this Project. Work required by the Plans or Specifications but not provided with a specific pay item shall be considered incidental to other items of Work. Final payment to the construction Contractor shall not be made until all Work has been finally completed and verified in accordance with the construction contract, Plans and Specifications and have been finally accepted by the Town of Addison.

17. **QUANTITIES:** The quantities in the Pay Items are approximate and may represent quantities in excess of those actually installed. Final Payment will be based on the actual measurement methods describe for each work item, which may be lump sum.

When the quantity of work to be done or materials to be furnished under any major pay item or contract is more than 125% of the quantity state in the Contract, whether stated by the Town or by the Contractor, then either party to the Contract upon demand shall be entitled to negotiate for revised consideration on the portion of work above 125% of the quantity stated in the Contract.

When the quantity of the work to be done or materials to be furnished under any major pay item of the contract is less than 75% of the quantity stated in the contract, whether stated by the Town of by the Contractor, then either party to the contract, upon demand, shall be entitled to negotiate for revised consideration on the portion of work below 75% of the quantity stated in the contract. This paragraph shall not apply in the even the Town deletes a pay item in its entirety from the contract.

18. **SUBSIDIARY WORK:** Any and all Work specifically governed by documentary requirements for the Project, such as conditions imposed by the Plans or these Special Provisions, in which no specific item for pay has been provided for in the Proposal, shall be considered as a subsidiary item of Work, the cost of which shall be included in the various

pay items in the Proposal. Costs of CCTV, permits, inspection fees, traffic control, construction staking, surface restoration and cleanup are general items of Work which fall in the category of subsidiary Work. Any repairs or replacement of items damaged during demolition or as a result of new construction will be considered subsidiary. Limits of all Work requiring repair will be determined by the Town of Addison staff or the inspector. Extreme care should be taken during all demolition and construction operations.

19. **QUALIFICATION OF PROPOSALS:** The Town of Addison reserves the right to reject any and all Proposals, to waive any and all informalities not involving price, time or changes in the Work, and the right to disregard all nonconforming, non-responsive, unbalanced, or conditional Proposals. The Town reserves the right to reject the Proposal of any Offeror if the Town believes that it would not be in the best interest of the Project to make an award to that Offeror, whether because the Proposal is not responsive or the Offeror is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by the Town. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

To be considered responsive, all Offerors are required to submit all information in the Instructions to Offerors Section and all Forms and Bonds, including the Statement of Experience per Section OQS "Offeror Qualification Statement", with their Proposal.

20. **AWARD AND EXECUTION OF CONTRACT:** Offerors must fill the proposal for all base and all alternate Pay Items. The method of Award will be based on the Offeror whose Proposal provides the best value to the Owner.

The Town reserves the right to accept whichever Proposal is determined to be in the best interest of the public or to reject all Proposals.

All payments will be based on actual quantities measured in the field and Pay Item unit prices.

21. **EXPLANATION OF CONTRACT TIME:** The term "Contract Time" as used in this Provision will mean the sum of the calendar days proposed by the contractor on the proposal form to achieve substantial completion of the project, a total of___calendar days. The term "calendar day" as used in this Articlewill mean every day shown on the calendar. The term "substantial completion" means that the improvements have been made suitable for use or occupancy or the facility is in conditionto serve its intended purpose, but still may require minor miscellaneous work and adjustment,as determined by the Owner. Calendar days will be consecutively counted from commencement of Contract Time (issuance of a Notice to Proceed) regardless of weather, weekends, and holidays, suspensions of Contractor's operations, delays or other events as described herein.

Upon receiving Notice to Proceed for construction, the selected contractor shall have _____calendar days to achieve **Substantial Completion** for the project which includes:

i. Completion of **all work** included in the Contract Documents.
ii. A Punchlist walk-through with the Town will be performed and provided to the Contractor. If elements of the project are not complete or numerous defects and/or deficiencies are found during the walk-through, the walk-

through will be suspended, and Contractor will be required to perform their own Quality Control walk-through and make corrections as needed. Once Contractor's Quality Control corrections has been completed,Contractor shall request another walk-through;

iii. The Contractor will have thirty (30) days to correct the items on the walk-through Punchlist and request a re-inspection from the Town. If Contractor fails to correct all repairs in this timeframe, Contract Time will be restarted Liquidated Damages may apply.

Final Acceptance of the project shall include:

i. All Punchlist items completed and accepted by the Town;
ii. Final clean-up after Punchlist corrections;
iii. Submittal of Contractor's Record Drawings; and
iv. Execution of Maintenance Bond.

In the event of a catastrophic event (i.e., war, invasion, riot, declared state of emergency, national strike, or other situations as declared by the Town of Addison) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Town shall agree as to the number of calendar days to extend the Contract Time. In the event the Contractor and Town are unable to agree to the number of calendar days to extend the Contract Time, the Town shall unilaterally determine the number of calendar days to extend the Contract Time reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Town were arbitrary or without any reasonable basis.

22. **COPIES OF PLANS FURNISHED:** One (1) full size set of plans, one (1) half size set of plans and one (1) electronic copyof the plans shall be furnished to the successful Contractor, at no charge, for construction purposes. These documents shall be marked as "Released for Construction" and shall be theonly version that shall be on site during construction.

23. **PRE-CONSTRUCTION CONFERENCE:** The successful Contractor, Engineer, and Town of Addison shall meet for a pre-construction conference before any of the Work begins on this Project. At this time, details of sequencing of the Work, contact individuals for each party, testing requirements, submittals, traffic control, time sensitive completion of the sewer pipeline and pay requests will be covered. Prior to the meeting, the Contractor shall prepare schedules showing the sequencing and progress of their Work and its effect on others.

Contractor shall provide other information, as deemed necessary by the Town, for the Pre-Construction Meeting to facilitate the meeting. A final composite schedule will be prepared during this conference to allow an orderly sequence of Project construction.

Prior to the start of construction, Contractor shall video the construction area and property adjacent to construction in the presence of the Town Inspector. The format shall be in a common video format and submitted on USB. The video shall be narrated to note location and details throughout the project. The Contractor shall furnish the Town of Addison two copies of the video in USB format prior to commencement of fieldwork on the Project. This shall be subsidiary to Project.

24. **MOBILIZATION:** Mobilization and Demobilization includes the movement of all labor, equipment and supplies, establishment of facilities necessary for work, and other work and operations which must be performed and cost not directly attributable to other pay items, excluding bidding costs, which must be incurred in order to enable the Contractor to begin work on other contract items. This item also incudes all work for removing all equipment and supplies and project site cleanup.

25. **GENERAL SEQUENCE OF CONSTRUCTION:** Prior to the start of Work, the Contractor shall develop a detailed construction and sequence of construction schedule using the critical path method (CPM) and submit to the Town of Addison and Architect for acceptance. The schedule shall be submitted electronically in a format compatible with Microsoft Project software. The CPM shall reflect all definable features of Work and activities that shall cause minimum interference to facility members during the course of construction. The schedule should take into consideration seasonal operations such as outdoor pool dates / hours. The schedule shall be Cost Loaded (with Pay Items) and allow for estimated monthly invoicing for the duration of the project. If the schedule or sequence becomes unworkable or unsatisfactory as Work proceeds, adjustments shall be made. Contractor shall provide a three-week look-ahead schedule each week at the Weekly Progress Meetings. During all phases of construction access to all existing businesses must be maintained at all times unless otherwise authorized in writing by the Town of Addison. Erosion control devices must be properly installed and maintained during all stages of construction.

The Contractor must comply with all work area restrictions as indicated in the Contract Documents unless specifically authorized in writing by the Town of Addison.

The general intent is for the contractor to begin within one area and steadily progress, limiting the area of construction to minimize disruptions to businesses along the route.

26. **PROJECT REPRESENTATIVE:** The Town of Addison, the Architect, the Contractor(s), and any applicable public utilities shall designate a single individual within their organization to act as liaison for the Project. This individual shall be aware of the day to day activities on the Project, have authority to make decisions binding on the party, and serve as single point for coordination of activities with the other team members.

27. **COORDINATION WITH OTHERS:** In the event that other Contractors are doing Work in the same area simultaneously with this Project, the Contractor shall coordinate this proposed construction with that of the other Contractors. The Town of Addison and/or the Architect shall mediate any disputes, and the Contractors shall comply with their decisions.

28. **INSURANCE:** Each insurance policy that the Contractor must furnish and keep current in accordance with these contract documents shall name the Town of Addison and the Engineer as additional insured. Contractor shall include in their proposal package a copy of their standard certificate of insurance showing compliance to the limits established by the Town of Addison.

1.0 The Contractor shall agree to furnish and maintain continuously during the period of this agreement, any renewals or extension, insurance coverage meeting all of the following requirements:

1.1 Commercial General Liability Insurance at minimum combined single limits of$1,000,000 per occurrence and $2,000,000 general aggregate for Bodily Injury and PropertyDamage, which coverage shall include Products/Completed Operations, and XCU Hazards.Coverage for product/completed operations must be maintained for at least one (1) year afterthe construction Work has been completed. Coverage must be amended to provide for an each-project aggregate limit of insurance. Contractual Liability must be included.

1.2 Workers Compensation Insurance at statutory limits, including employer's liability coverage at minimum limits of $1,000,000 each occurrence-each accident, $1,000,000 by disease-each occurrence and $1,000,000 by disease aggregate

1.3 Commercial Automobile Liability Insurance at minimum combined single limits of$1,000,000 per occurrence for bodily injury and property damage, including owned, non- owned, and hired car coverage.

1.4 Umbrella Liability at minimum limits of $1,000,000 each-occurrence $4,000,000 aggregate with respect to primary commercial general liability, automobile liability and employer's liability policies.

1.5 Any Subcontractor(s) hired by the Contractor shall maintain insurance coverage equalto that required by the Contractor. It is the responsibility of the Contractor to assure compliance with this provision. The Town accepts no responsibility arising from the conduct, or lack of conduct, of the Subcontractor.

1.6 A comprehensive general liability insurance form may be used in lieu of a commercialgeneral liability form. In this event, coverage must be written on an occurrence basis, at limits of $1,000,000 each-occurrence, combined single limit and coverage must include a broad form comprehensive general liability endorsement, products/completed operations, XCU hazards and contractual liability.

2.0 With reference to the foregoing insurance requirements, Contractor shall specifically endorse applicable insurance policies as follows:

2.1 The Town shall be named as an additional insured with respect to general liability and automobile liability.

2.2 All liability policies shall contain no cross liability exclusions or insured versus

insured restrictions.

2.3 A waiver of subrogation in favor of the Town of Addison shall be contained in the workers compensation and all liability policies.

2.4 All insurance policies shall be endorsed to require the insured to immediately notify the Town of Addison of any material changes in the insurance coverage.

2.5 All insurance policies shall be endorsed to the effect that the Town will receive at least thirty (30) days written notice prior to cancellation or non-renewal of the insurance.

2.6 All certificates shall be mailed to Town of Addison, Purchasing Dept., P.O. Box 9010, Addison, Texas 75001 or emailed to purchasing@addisontx.gov.

2.7 All insurance policies, which name the Town as an additional insured, must be endorsed to read as primary coverage regardless of the application of other insurance.

2.8 Required limits may be satisfied by any combination of primary and umbrella liability insurances.

2.9 Contractor may maintain reasonable and customary deductibles, subject to approval by the Town.

3.0 All insurance shall be purchased from an insurance company who meets the following requirements:

3.1 Must be issued by a carrier, which is rated "A-" VII or better by A.M. Best's Key Rating Guide.

3.2 Licensed and admitted to do business in the State of Texas and is a subscriber to the Texas Guaranty Fund.

4.0 All insurance must be written on forms filed with and approved by the Texas State Board of Insurance. Certificates of insurance shall be prepared and executed by the insurance company or its authorized agent and shall contain provisions representing and warranting the following:

4.1 Set forth all endorsements and insurance coverages according to requirements and instruction contained herein.

4.2 Shall specifically set forth the notice-of-cancellation or termination provisions to the Town.

4.3 Provide a name, e-mail address, mailing address and contact person for any Insurance related questions or claims.

5.0 Upon request, Contractor shall furnish the Town of Addison with certified copies of all insurance policies.

WORKERS' COMPENSATION INSURANCE COVERAGE:

A. Definitions.

Certificate of Coverage ("certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Texas Workers' Compensation Commission (the

"TWCC"), or a coverage agreement (TWCC-81, TWCC-82, TWCC-83 or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a Project, for the duration of the Project.

Duration of the Project - includes the time from the beginning of the Work on the Project until the Contractor's/person's Work on the Project has been completed and accepted by the governmental entity.

Persons Providing Services on the Project ("Subcontractor" in Section 406.096 of the Texas Labor Code) - includes all persons or entities performing all or part of the services the Contractor has undertaken to perform on the Project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitation, independent Contractors, Subcontractors, leasing companies, motor carriers, Town-operators, employees of any such entity or employees of any entity which furnishes persons to provide services on the Project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a Project. "Services" does not include activities unrelated to the Project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

A. The Contractor shall provide coverage, based on property reporting of classification codes and payroll amounts and filing of any coverage agreement, which meets the statutory requirements of Texas Labor Code, 401.011(44) for all employees of the Contractor providing services on the Project, for the duration of the Project.

B. The Contractor must provide a certificate of coverage to the Town of Addison prior to being awarded the contract.

C. If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the Project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the Town of Addison, showing that the coverage has been extended.

D. The Contractor shall obtain from each person providing services on the Project, and provide to the Town of Addison:

   (1) A certificate of coverage, prior to that person beginning Work on the Project, so that the Town of Addison will have on file certificates of coverage showing coverage for all persons providing services on the Project; and,
   (2) no later than seven days after receipt by the Contractor, a new certificate of coverageshowing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

E. The Contractor shall retain all required certificates of coverage on file for the duration of the Project and for one year thereafter.

F. The Contractor shall notify the Town of Addison in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services onthe Project.

G. The Contractor shall post on each Project site a notice, in the text, form and manner

prescribed by the TWCC, informing all persons providing services on the Project that they are required to be covered, and stating how a person may verify current coverage and reportfailure to provide coverage.

H. The Contractor shall contractually require each person with whom it contracts to provide Services on a Project to:

(1) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Codes 401.011 (44) for all its employees providing services on the Project, forthe duration of the Project;

(2) provide to the Contractor, prior to that person beginning Work on the Project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the Project, for the duration of the Project;

(3) provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

(4) obtain from each person with whom it contracts, and provide to the Contractor;

a. a certificate of coverage, prior to the other person beginning Work on the Project; and,
b. a new certificate of coverage showing extension of the coverage period, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverageends during the duration of the Project.

(1) retain all required certificates of coverage on file for the duration of the Project and for one year thereafter;

(2) notify the Town of Addison in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project; and

(3) contractually require each other person with whom it contracts to perform as requiredby paragraphs (1) - (7) with the certificate of coverage to be provided to the person for whomthey are providing services.

I. By signing this contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the Town of Addison that all employees of the Contractor who will provide services on the Project will be covered by worker's compensation coveragefor the duration of the Project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed withthe appropriate insurance carrier or, in the case of a self-insured, with the TWCC's Divisionof Self-Insurance Regulation. Providing

false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties or other civilactions.

J. The Contractor's failure to comply with any of these provisions is a breach of contract bythe Contractor which entitles the Town of Addison to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach fromthe Town.

The following is the form of notice of workers' compensation coverage prescribed by the TWCC. Pursuant to Section 110.110 (d) (7), this notice must be printed with a title in at least 30-point bold type, and text in at least 19-point nominal type, and shall be in both English and Spanish and any other language common to the worker population.

REQUIRED WORKERS' COMPENSATION COVERAGE

"The law requires that each person working on this site or providing services related to this construction Project must be covered by workers' compensation insurance. This includes persons providing, hauling or delivering equipment or materials, or providing labor or transportation or other service related to the Project, regardless of the identity of their employer or status as an employee.

"Call the Texas Workers' Compensation Commission (TWCC) at (512) 440-3789 to receive further information on the legal requirements for coverage, to verify whether your employer has provided the required coverage, or to report an employer's failure to provide coverage."

29. **RESOLUTION OF DISPUTES:** The parties hereby covenant and agree that in the event of any controversy, dispute, or claim, of whatever nature arising out of, in connection with or in relation to the interpretation, performance or breach of this Contract, including but not limited to any claims based on contract, tort or statute, before filing a lawsuit, the parties agree to submit the matter to Alternative Dispute Resolution pursuant to the laws of the State of Texas. The parties shall select a third-party arbitrator or mediator from the current list of neutrals on file with the Alternative Dispute Resolution Administrator of the Dallas County District Courts or other mutually agreeable mediator or arbitrator. All forms of Alternative Dispute Resolution may be used except binding arbitration. The proceedings shall be conducted in accordance with the laws of the State of Texas.

30. **SHOP DRAWINGS:** The Contractor shall provide, review, approve and submit all shop drawings, product data and samples required by the Town of Addison, the Architect and the Contract Documents in accordance with Project Manual Section 01 3300. The Contractor shall furnish shop drawings in electronic format (PDF) and printed copy for review by the Engineer who will review, approve and forward to the Town of Addison for acceptance. Approved submittals will be returned via email to the following parties:

Town of Addison
Contractor
LPA, Inc. (Architect for Construction Administration)

Shop drawings shall include all items to be installed in the Project, including but not limited to:

31. **PROJECT PHOTOGRAPHS:** Prior to the start of construction, Contractor shall photograph the construction area and property adjacent to construction in the presence of the Town Inspector.The format shall be in common photo format (JPG) and submitted on USB. The photos shall be named to note location and details throughout the project. The Contractor shall furnish the Town of Addison two copies of the photos on USB format prior to commencement of fieldwork on the Project. This effort shall be considered as subsidiary to the various pay items for this Project.

32. **SAMPLES AND TESTS OF MATERIALS:** The Town of Addison shall designate and pay an independent testing laboratory to furnish Quality Assurance testing for this Project. Random testing will be provided by the independent lab as necessary for compliance with the Specifications. The Contractor shall coordinate construction with the Town of Addison, and shall provide assistance to the testing labs by providing excavation, access, trench safety, traffic control, materials for testing and any other Work required to insure all testing requirements are met. Work performed to accommodate testing will be a subsidiary item and no extra payment will be authorized. All costs for the field Quality Assurance testing shall be paid for by the Town of Addison, except for any and all failed testing, which shall be paid by the Contractor and such cost shall be deducted from monthly pay requests. Contractor shall be responsible for providing any testing that is required by the Contractor in the Specifications and for any Quality Control testing required to assure that the Town's Quality Assurance Testing passes.

Testing will be provided as available and will usually be required during normal working hours with 24-hour notice. Night, weekend and holiday testing must be coordinated at least 48-hours in advance and are subject to re-scheduling based on testing personnel availability.

All samples and tests shall be performed in accordance with the Standard Specifications for Public Works Construction, North Central Texas Council of Governments (Fifth Edition) as amended or supplemented or the agency governing the specific specifications of testing for the product/material.

33. **INSPECTION:** The Town of Addison and the Architect reserve the right to inspect, test, measure or verify the construction Work for this Project as they deem necessary to ascertain that the Work is being accomplished in accordance with the standards and requirements set forth in the Contract Documents. Notwithstanding such reviews, the Contractor will be held responsible for the finished Work and any acceptance of the Work by the Town or

governmental agencies will not relieve the Contractor from responsibility for the Work. The Town reserves the right to place full-time construction inspectors at the site of the Work. Costs for inspection services will be paid by the Town of Addison. The Contractor shall provide assistance to the Town of Addison and the Engineer by providing excavation, trench safety, or other Work necessary to facilitate inspection activities, and shall give sufficient notice well in advance of pending construction activities for scheduling of inspectionservices. Inspections will be provided as available and will usually be required during normalworking hours with 24-hour notice. Night, weekend and holiday Inspection must becoordinated at least 48-hours in advance and are subject to re-scheduling based on Inspectoravailability.

If the Specifications, the Town's instructions, laws, ordinances, or any public authority require any Work to be specially tested, the Contractor shall give the Town timely notice of its readiness for testing, and if the testing is by an authority other than the Town, of the date fixed for such testing. Tests by the Town shall be made promptly, and where practicable at the source of supply.

5.0 **ACCESS ROUTES, STAGING AREAS AND STORAGE AREAS:** All access routes and the location of job site trailers, staging areas, and storage areas shall be subject to the approval of the Town and the Architect. The Contractor shall may utilize a portion of the southwest parking lot located at the Athletic Club for staging and limited employee parking. This area must be fenced and screened from general view of the public. The Contractor is responsible for maintaining and repairing all roads and other facilities used during construction at the Contractor's expense. Upon completion of the Project all existingroads and other disturbed areas shall be left in a condition equal to that at the time the Contractor commences Work on this Project.

34. PROPERTY ACCESS: Access to the facility and adjacent properties shall be maintained at alltimes unless otherwise directed by the Architect and/or Town of Addison. Contractor shall also maintain sufficient access throughout the project limits at all times. Access of the building by members must be maintained at all times.

35. PROTECTION OF EXISTING UTILITIES AND STRUCTURES: The location and dimensions shown on the Plans relative to existing utilities and subsurface structures are based on the best records and/or field information available and are not guaranteed by the Town of Addison or the Engineer to be accurate as to location and depth. It shall be the Contractor's responsibility to verify exact locations of adjacent and conflicting utilities sufficiently in advance of its activities in order that they may negotiate such restrictive locations with the Town of Addison and the conflicting utility to allow for adjustments in the proposed work to provide adequate clearances. The Contractor shall take all necessary precautions in order to protect all utilities and services encountered, whether or not they are indicated on the Plans. All damage to utilities resulting from Contractor's operations shall be restored at the Contractor's expense. The Town of Addison and the Engineer assume no responsibility for failure to show any or all of these utilities or structures on the Plans, or to show them in their exact locations. It is mutually agreed that such failure shall not be considered sufficient basis for claims for additional compensation for Extra Work or for increasing the pay quantities in any manner whatsoever, unless the obstruction encountered is such as to necessitate notable changes in the lines or grades, or requires the building of special Work, provisions for which are not made in the Plans, in which case, provisions in these Specifications for Extra Work shall apply.

36. **PUBLIC UTILITIES AND OTHER PROPERTY TO BE CHANGED:** In case it is necessary to change or move the property of a public utility, such property shall not be moved or interfered with until authorized by the Town of Addison or the Engineer. The right is reserved for the Owner of public utilities to enter upon the limits of the Project for the purpose of making such changes or repairs of their property that may be made necessary by performance of the Contract. The Contractor shall be responsible for coordination with the Town of Addison and the Engineer, and all utility companies whose utility lines or streets may be affected by the proposed improvements. The Contractor shall observe the following:

a. Prior to any excavation, the Contractor shall determine the locations of all existing water, gas, sewer, electric, telephone, telegraph, television, pipelines and other underground utilities and structures.

b. After commencing Work, the Contractor shall use every precaution to avoid interference with existing underground and surface utilities and structures, and to support them and protect them from damage.

c. Where the locations of existing underground and surface utilities and structures are indicated, these locations are generally approximate, and all items which may be encountered during the Work are not necessarily indicated. The Contractor shall determine the exact locations of all items indicated, and the existence and locations of all items not indicated.

d. The Contractor shall repair or pay for the repair of all damage caused by its operations to all existing utility lines, public property, and private property, whether it is below ground or above ground, and he shall defend and settle in total the cost of all lawsuits which may arise as a result of its operations.

e. To avoid unnecessary interferences or delays, the Contractor shall coordinate all utility removals, replacements and construction with the appropriate utility company, and provide this information to the Town of Addison and the Engineer. The Town of Addison and the Engineer will not be liable for damages due to delay as a result of the above.

37. **MAINTENANCE AND REPAIRS:** The Contractor shall maintain and keep in good repair all Work contemplated under these Contract Documents which shall include the maintenance and repair of all existing streets, storm sewer crossings, utility crossings, temporary crossings for access to adjacent property, barricades, lights, warning signs and signals, and all Work which is necessary for the well-being of the general public. In the event the Contractor fails in its obligations to properly maintain the Work, the Town of Addison shall make such repairs as are necessary and the cost of such repairs shall be deducted from payment due the Contractor.

38. **PROTECTION OF WORK:** During performance and up to date of final acceptance, the Contractor shall be under the absolute obligation to protect the finished Work against damage, loss or injury. In the event of damage, loss or injury, the Contractor shall promptly replace or repair such Work, whichever the Town of Addison shall determine to be preferable. The obligation to deliver finished Work in strict accordance with the contract prior to final acceptance shall be absolute and shall not be affected by the Town of Addison's

approval of or failure to prohibit means and methods of construction used by the Contractor. All risk of loss or damage to the Work shall be borne solely by the Contractor until final acceptance of all Work by the Town of Addison, as evidenced by the Town of Addison's issuance of a certificate of final acceptance.

39. **PUBLIC CONVENIENCE AND SAFETY:** In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for conditions of the Project site, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and not be limited to normal Work hours.

The Contractor shall take into account that this is an "Open and Functioning Facility" andthat construction methods, equipment and access will be limited. Methods utilized must takeinto account the amount of dust, vibration and noise generated. Limited work area and storage area will require that debris must be removed from the site daily.

Materials stored about the Work site shall be so placed, and the Work shall at all times be so conducted, as to cause no greater obstruction to the members using the facility than is considered necessary by the Town of Addison. Materials shall be placed so as not to endanger the Work or prevent free access to point of ingress / egress, safety equipment, fire alarm and phones.

The right to remedy any neglect on the part of the Contractor as regards to the public convenience and safety which may come to the Town ofAddison's attention, after 24 hours notice in writing to the Contractor, save in cases of emergency, when the Town of Addison shall have the right to remedy any neglect without notice; and, in either case, the cost of such Work done by the Town of Addison shall be deducted from the monies due or to become due the Contractor. The Contractor shall notifythe Town of Addison and the Architect when any street is to be closed or obstructed. The Contractor shall provide for emergency vehicle access at all times.

40. **PROTECTION OF PERSONS AND PROPERTY**: The Contractor shall have the responsibility to provide and maintain all warning devices and take all precautionary measures required by law or otherwise necessary to protect the Work and persons and property while said persons or property are approaching, leaving or within the Work site or any area adjacent to said Work site. No separate compensation shall be paid to the Contractor for the installation or maintenance of any protective measures, warning devices, barricades, lights, signs, or any other precautionary measures required by law or otherwise necessary for the protection of persons or property.

The Contractor shall assume all responsibilities to the general public in connection with the general public's immediate approach to and travel through the Work site and the area adjacent to said Work site.

41. **BARRICADES, WARNING SIGNS, DETOURS AND SEQUENCE OF CONSTRUCTION:** Throughout the construction operations, streets and intersections will remain open to traffic by constructing the Work in stages. All streets, driveways, adjacent business and alleys shall remain open to traffic as far as is practicable.

A. General Construction: The Contractor shall plan its Work sequence in a manner that will minimize interference with building traffic and use during construction operations. Before beginning Work on this Project, the Contractor shall submit, for approval by the Town of Addison, a plan of construction operations outlining in detail a sequence of Work to be followed; setting out themethod of barricading area of construction and preventing member access to construction areas.

42. **TRENCH EXCAVATION, BACKFILL AND COMPACTION:** Trench excavation, backfill and compaction of water and sewer utility trenches shall be in accordance with Town of Addison Standards and with details shown in the Contract Documents.

A. Trench Excavation: If the stated maximum trench widths are exceeded, either through accident or otherwise, and if the Engineer determines that the design loadings of the pipe will be exceeded, the Contractor will be required to support the pipe with an improved trench bottom. The expense of such remedial measures shall be entirely the Contractor's own. All trenching operations shall be confined to the width of permanent rights-of-way, permanent easements and any temporary construction easements. All excavation shall be in strict compliance with the Trench Safety Systems Special Condition of this document.

B. Trench Backfill: Trenches shall be backfilled above the top of the embedment material with approved backfill material per Town of Addison Standards for the appropriate pipe size, pipe material, depth, and soil condition.

C. Compaction: All trenches under proposed or existing pavement shall be compacted to within a range of 95% to 100% Standard Proctor Density. Trenches which lie more than one (1') outside limits of pavement shall be compacted to a minimum of 90% Standard Proctor Density (ASTM D-698). Densities shall be taken at optimum moisture content to +3% of optimum moisture content for the material.

43. **TRENCH WALLS:** The Contractor shall follow the Trench Safety Plan and all OSHA Guidelines to protect existing improvements. Protection of existing improvements shall be subsidiary to the linear foot cost of the pipe and not a separate pay item.

44. **SUSPENSION OF WORK RELATED TO DANGER:** In addition to the other remedies for suspension of the Work as provided for in the General Provisions and Special Provisions, the Town of Addison has the authority to suspend all work immediately if, in the Town of Addison's opinion, there is imminent danger to workers or the general public. If there is no

imminent danger to workmen or the general public, but trench conditions are not in compliance with Federal Regulations 29 C.F.R. 1926.650-1926.652, the Town of Addison shall warn the Contractor who shall then immediately order all workmen in and adjacent to the trench away from the area. The Contractor must then bring the trench into compliance with the regulations. If the Contractor does not make the required corrections, all work on the Contract shall cease and the Town of Addison will issue a letter of Temporary Suspension of Work. The only work authorized after issuance of this letter is work approved by the regulations. Other work shall not be permitted until the Town of Addison issues a letter of Release of Temporary Suspension of Work. The Contractor shall not be entitled to additional compensation, an extension of time or payment of damages as a result of a temporary suspension of work under this provision.

45. **PROPERTY LINES AND MONUMENTS:** The Contractor shall locate and protect all property corner markers present in the field, and when any such markers or monuments are in danger of being disturbed, they shall be properly referenced and if disturbed shall be reset by a Registered Professional Land Surveyor registered in the State of Texas at expense of the Contractor.

46. **CONSTRUCTION STAKING:** Construction staking will not be provided by the Town of Addison or Engineer. This item will be performed by the Contractor and shall be subsidiary to other pay items. The Contractor will also be responsible for maintaining stakes. If re-staking is required for any reason, it will be the Contractor's responsibility, including associated costs.

All construction staking shall be done under the supervision of a Registered Professional Land Surveyor registered in the State of Texas. The Contractor shall submit copies of cut sheets and field books for the construction of all paving, water, wastewater, and stormwater improvements to the Town of Addison for review prior to construction of the improvements. Review time will depend on the amount of Cut Sheets submitted and currently under review at any given time. Make submittals as soon as possible to allow for review process and acceptance prior to the Cut Sheets being needed.

The information on the cut sheets and field books shall include but not be limited to the following:

a. Heading to include date, contract number, Project name, surveying firm, Contractor, and construction plan sheet number.

b. Location, description of street/line and street/line name, number, letter, etc. designation.

c. Benchmark Data: Location, description, and elevation.

d. Slope or percent of grade of each curb line or utility line.

e. Stations at 50-foot intervals and including all PC, PT, PI, PVC, PVI, PVT, PRC, grade changes, etc. Include elevations of existing pavement at all tie-in points.

f. Offset description including distance to center line or back of curb and direction of offset; left, right, east, west, etc,

g. Cut to subgrade, pavement, top of curb, or flowline of the street or utility being staked.

h. Clarifying remarks such as top of curb, gutter, pavement, subgrade, manhole, cleanout, valve, tee, cross, fire hydrant, wastewater lateral, water service, etc.

i. Cut sheets shall be signed by a Texas Registered Professional Land Surveyor.

47. **DURING CONSTRUCTION**: During construction of the Work, the Contractor shall, at all times, keep the site of the Work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove same from any portion of the site if, in the opinion of the Town of Addison or the Engineer, such material, debris or rubbish constitutes a nuisance or is objectionable. Contractor shall remove spoil and debris from the Project Area daily and shall limit stockpiling of new material that is not ready to be incorporated into the work. In case of failure on the part of the Contractor to maintain a clean site, the Town of Addison may, upon 24 hour written notice, clean the site, and the cost thereof shall be deducted from any monies due or to become due to the Contractor under its contract; or where sufficient contract funds are unavailable for this purpose, the Contractor or its surety shall reimburse the Town of Addison for all such costs.

48. **CONTRACTOR'S CONTINUING OBLIGATION:** Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by the Town of Addison, nor the issuance of a certificate of Substantial Completion, nor any payment by Town of Addison toContractor under the Contract Documents, nor any use or occupancy of the Work or any partthereof by Town of Addison, nor any act of acceptance by Town of Addison nor any failureto do so, nor any review and acceptance of a Shop Drawing or sample submission, nor the issuance of a notice of acceptability by the Town of Addison pursuant to final payment nor any correction of defective Work by Town of Addison will constitute an acceptance of Work not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents.

49. **TOPSOILING, FERTILIZING AND SEEDING:** This item shall cover the topsoiling, seeding, fertilizing, watering and required maintenance for the grassing of all other areas of the project site that have been disturbed by this Contractor's operations. All disturbed areas requiring seeding and fertilizing shall be considered subsidiary to the cost of the project. Topsoiling, fertilizing and seeding shall be provided in accordance with NCTCOG Items 202.2, 202.4, and 202.6, respectively.

50. **IRRIGATION AND SPRINKLER REPAIR:** The Contractor shall restore or retrofit existing irrigation or install new irrigation systems along Midway Road where existing irrigation systems are disturbed by construction. Contractor shall coordinate with the system owners and identify all existing systems and their operational condition before any work occurs in the area. Work shall be performed in accordance with the plans, details and Town of Addison Irrigation Specifications. **The Contractor will be responsible for any vegetation that dies as a result of damage to the irrigation system and replace it with equal vegetation at its own cost.**

51. **REMOVAL OF DEFECTIVE AND UNAUTHORIZED WORK:** All Work which has

been rejected or condemned shall be repaired; or if it cannot be repaired satisfactorily, it shall be removed and replaced at the Contractor's expense. The Contractor shall submit a Corrective Action Plan for any deficient or non-conforming item for review and acceptance by the Town of Addison and the Engineer. Corrective action shall not begin until the Corrective Action Plan is accepted by the Town and returned to the Contractor. Defective materials shall be immediately made safe or removed from the Work site if they pose a safety concern. Work done without line and grade having been provided; Work done beyond the line or not in conformity with the grades shown on the accepted Cut Sheets, Work done without proper inspection; or any Extra or unclassified Work done without written authority and prior agreement in writing as to prices, shall be at the Contractor's risk and will be considered unauthorized, and at the option of the Town of Addison may not be measured and paid for and may be ordered removed at the Contractor's expense. Upon failure of the Contractor to repair satisfactorily or to remove and replace, if so directed, rejected, unauthorized or condemned Work or materials after receiving notice from the Town of Addison, the Town will, after giving written notice to the Contractor, have the authority to cause defective Work to be remedied or removed and replaced, or to cause unauthorized Work to be removed and to deduct the cost thereof from any monies due or to become due the Contractor.

52. **DISPOSITION AND DISPOSAL OF MATERIALS:** All materials to be removed from the site including refuse and other debris shall become the property of the Contractor, unless specifically stated otherwise in these provisions or the description of pay items, and shall be disposed of outside the limits of the Project. Contractor shall also comply with all applicable laws governing the spillage of debris while transporting to a disposal site. See Special Provision 59 for additional requirements.

53. **CLEAN-UP FOR FINAL ACCEPTANCE:** The Contractor shall make a final cleanup of all parts of the Work before acceptance by the Town of Addison. This cleanup shall include removal of all objectionable rock and other construction materials, and in general preparing the site of the Work in an orderly manner and appearance.

54. **TESTING REQUIREMENTS:** Testing shall be conducted in accordance with Town of Addison Specifications except as modified in the Special Provisions, Technical Specifications, or other Contract Documents. Also see Special Provision 35 for additional requirements.

The Town of Addison shall designate and pay an independent testing laboratory to furnish Quality Assurance testing for this Project. Random testing will be provided by the independent lab as necessary for compliance with the Specifications. The Contractor shall coordinate construction with the Town of Addison and shall provide assistance to the testing labs by providing excavation, access, trench safety, traffic control, materials for testing and any other Work required to insure all testing requirements are met. Work performed to accommodate testing will be a subsidiary item and no extra payment will be authorized. All costs for the field Quality Assurance testing shall be paid for by the Town of Addison, except for any and all failed testing, which shall be paid by the Contractor and such cost shall be deducted from monthly pay requests. Contractor shall be responsible for providing any testing that is required by the Contractor in the Specifications and for any Quality Control testing required to assure that the Town's Quality Assurance Testing passes. As a general guide, the Town shall be responsible for providing the following Quality Assurance tests:

Contractor will be responsible for all other testing, including, but not limited to:

1) Testing, Adjusting, and Balancing for HVAC
2) Preconstruction Testing
3) Product Tests

Contractor shall submit to the Town of Addison and Architect, the qualifications of the firm they propose to use for their Quality Control and other testing. Town must accept the Contractor's Testing Firm prior to any testing being undertaken. Testing Firm must deliver test results to the Town of Addison and the Architect at the same time they are delivered to the Contractor. The Town Inspector shall be provided advance notification of all Contractor testing and be provided the opportunity to observe the testing.

55. **CLAIMS FOR DAMAGES OR INJURY:** If any person files a claim against the Town of Addison or Contractor for personal injury or property damage resulting from, arising out of, or caused by, the operations of the Contractor, or any Work within the limits of the Project, the Contractor must either submit to the Town of Addison, a duly executed full release within thirty (30) days from the date of written claim, or immediately report the claim to its liability insurance carrier for their action in adjusting the claim. If the Contractor fails to comply with this provision within the stipulated time limit, it will be automatically deemed that the Contractor has appointed the Town as it's irrevocable Attorney-In-Fact authorizing the Town to report the claim directly with the liability insurance carrier. This provision is in and of itself a Power-of-Attorney from the Contractor to the Town which authorizes the Town to take said action on behalf of the Contractor without the necessity of the execution of any other document. If the Contractor fails to comply with the provisions of this item the Town, at its own discretion, may terminate this contract or take any other actions it deems appropriate. Any payment or portion thereof due the Contractor, whether it is a final payment, progress payment, payment out of retainage or refund payment may be withheld by the Town as is authorized by Item 109.4. Bankruptcy, insolvency or denial of liability bythe insurance carrier shall not exonerate the Contractor from liability.

As a result of the additional Work created to Town of Addison due to un-responded claims for damages by Contractor to third parties, Contractor shall incur penalties for failure to abide by this Special Provision.

Contractor shall respond to the claimant in writing regarding the status of the claim, including whether Contractor disputes the claim, wishes to settle, or will notify its liability insurance carrier regarding the claim. Contractor will be assessed a penalty by the Town of $75.00 per claim, for its failure to respond to the claimant as described above within thirty days of its written notice of claim by the Town.

To ensure Contractor compliance, the Town of Addison shall be notified, by copied correspondence of responses or settlement by Contractor.

.**WAIVER OF CLAIMS:** The making and acceptance of final payment will constitute:

A. A waiver of all claims by Town of Addison against Contractor, except claims arising from unsettled Liens, from defective Work appearing after final inspection or failure to

comply with the Contract Documents or the terms of any special guarantees specified therein; however, it will not constitute a waiver by Town of Addison of any rights in respect of Contractor's continuing obligations under the Contract Documents.

B. A waiver of all claims by Contractor against Town of Addison other than those previously made in writing and still unsettled.

56. **MECHANICS AND MATERIALMEN'S LIEN:** The Contractor shall be required to execute a release of mechanics and materialmen's liens upon receipt of payment and shall ensure that the Project remains free and clear of all liens related to the Work. The Contractor shall have all liens removed by obtaining releases acceptable to the Town of Addison or shall bond around such liens by obtaining a discharge of all liens.

57. **CONTRACTOR'S AFFIDAVIT OF BILLS PAID:** The Contractor shall be required to execute the form provided in Section BP prior to the acceptance of the Project.

58. **RECORD DOCUMENTS:** The Contractor shall maintain record Plans and legibly annotate shop drawings to record changes made after review. A red marking pen shall be used for all recording. All marking must be clear and legible.

Maintenance of Documents: The Contractor shall maintain at the job site one record copy of the Contract Plans, Specifications, Shop Drawings, Change Orders, other modification to the Contract, field test records and other documents submitted by Contractor in compliance with specification requirements. These documents shall be maintained at the job site apart from documents used for construction. These documents are not to be used for construction purposes. The documents shall be maintained in clean, legible condition. The documents shall be made available at all times for inspection by the Town. The Contractor shall keep the Record Documents current and shall be updated within five (5) days of the work occurring. The Town will review the Record Drawings at least once a month and prior to Pay Application submittal.

Recording: Each document shall be labeled Project Record Copy in 2-inch high printed letters. The record documents shall be kept current. No Work shall be covered until required information has been obtained.

Contract Plans: The appropriate drawing shall be legibly marked to record, where applicable:

a. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

b. Field changes of dimension and detail made during construction process.

c. Changes made by Change Order or Supplemental Agreement.

d. Details not on original Contract Plans, such as existing utility locations or improvements encountered during construction.

e. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

f. All Landscape and irrigation components within the work area of the project.

g. Changes made by Change Order or Supplemental Agreement.

h. Other matters not originally specified.

Shop Drawing: The Contractor shall maintain the Shop Drawings as record drawings and legibly annotate shop drawings to record changes made after review.

Submittal: At the completion of the Project, the Contractor shall deliver the Record Documents and an electronic file in PDF format and on USB containing them to the Town. A second set of Record Documents of the work that crosses the DART RR ROW shall be kept and submitted within 15 days of completion of work in the ROW. The transmittal letter shall be accompanied, in duplicate, with:

a. Date, Project title and number.

b. Contractor's name and address.

c. A Listing showing the Title and number of each Record Document included in the submittal.

d. Certification that each document as submitted is complete and accurate.

e. Signature of Contractor or its authorized representative and their printed name and title.

59. OWNERSHIP OF WORK AND MATERIALS: All Work performed by Contractor pursuant to the Contract shall be the property of the Town of Addison. The Town of Addison shall own all construction, and any data, documents, plans, specifications, working papers, computer programs, photographs, or other material produced by Contractor pursuant to the Contract, and Contractor hereby assigns and transfers to the Town of Addison any and all copyrights for such material. To the extent that such programs used are internal, proprietary programs used by Contractor in the performance of the Work, Contractor will provide the Town of Addison such access to the programs as is necessary for the Town of Addison to be able to use the products and documents generated by the program, but Contractor is not required to transfer the copyrights or other intellectual property rights to the program to the Town of Addison. As security for partial, progress, or other payments, title to work for which such payments are made shall pass to the Town of Addison at the time of the payment. To the extent that title has not previously been vested in the Town of Addison by reason of payments, full title shall pass to the Town of Addison at delivery of the Work at the location specified in the Contract.

Unincorporated Work to which the Town of Addison has received title by reason of progress, partial or other payments shall be segregated from other Contractor or Subcontractor materials and clearly identified as the Town of Addison property. The Contractor shall be responsible for all materials until they have been incorporated into the Work and the Work has been finally accepted by the Town of Addison. The title transferred as above shall in each case be good, and free and clear of any and all security interests, liens, or other encumbrances.

The Contractor promises and agrees that it will not pledge, hypothecate, or otherwise encumber the items in any way that would result in any lien, security interest, charge, or claim upon or against said items. The transfer of title as provided above shall notimply acceptance by the Town of Addison, nor relieve Contractor from the responsibility tostrictly comply with the Contract, and shall not relieve Contractor of responsibility for any loss of or damage to such items.

The Contractor shall insert provisions in its subcontracts sufficient to ensure compliance with the content of this Section.

60. **DRAWINGS AND OTHER DATA:** All documents developed by Contractor in the performance of the Contract shall become the sole property of the Town of Addison and may be used by the Town of Addison on any other project without additional compensation to Contractor. Use by the Town of Addison of these documents on other projects does not confer any liability on Contractor.

The Town of Addison shall be considered the "person for whom the work was prepared" for the purpose of authorship in any copyrightable work under 17 U.S.C. § 201(b). With respect thereto, Contractor agrees not to assert or authorize others to assert any rights or establish any claim under the design related patent and copyright laws. All design drawings, as-built drawings and specifications, in any form, shall contain a copyright mark of the Town of Addison.

61. **TOWN OF ADDISON APPROVAL:** This Project is subject to final approval and acceptance by the Town of Addison. Final approval acceptance will not be given until the punch list items are completed to the Town's satisfaction and Record Documents are accepted by the Town of Addison.

62. **POWER FOR CONSTRUCTION:** The Contractor may use power from the facility unless construction power demands exceed the facilities capabilities in which the contractor will be responsible for providing alternative power sources to supplement construction operations.

63. **LIQUIDATED DAMAGES:** If the Contractor fails to complete the Work within the time specified in the contract, the Contractor shall pay liquidated damages to the Town of Addison in the amount of **$ 500** for each calendar day of delay until the Work is completed or Substantial Completion is achieved for each the South and North Segments of the Project. If the Punchlist items from the Substantial Completion walk-through are not completed within thirty (30) days of issuance, Contract Time will re-start and Liquidated Damages will again apply.

64. **CONTRACT DELAY:** The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, Work performed, disruptions, permitting issues, actions of subcontractors, suppliers, or other contractors, actions by third parties, weather, weekends, holidays, or other such events, forces or factors sometimes experienced in construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the Contract time for completion. Further, any and all costs or impacts whatsoever incurred by the

Contractor in accelerating the Work to overcome or absorb such delays or events in an effort to complete the Contract prior to expiration of the Contract time to complete, regardless of whether the Contractor does so or not, shall be the sole responsibility of the Contractor in every instance.

65. **SUBCONTRACTORS:** No subcontract shall relieve Contractor of any of Contractor's obligations or liabilities under the Contract. Contractor shall be fully responsible and liable for the acts or omissions of all Subcontractors, including persons directly or indirectly employed by them, their guests and invitees. Contractor shall have sole responsibility for managing and coordinating the operations of its Subcontractors, including the settlement of disputes with or between them. Nothing contained in the Contract shall be deemed to create a contractual relationship between any Subcontractor, and the Town of Addison.

Contractor shall provide to the Town of Addison one (1) copy of all executed subcontracts associated with the Contract, including any changes or modifications to the subcontracts, within three (3) days of their execution. No Subcontractor shall be permitted to perform work associated with the subcontract until the Subcontractor (or Contractor on the Subcontractor's behalf) is in compliance with the insurance requirements specified elsewherein the Contract, and has furnished satisfactory evidence of insurance to the Town of Addison.

66. **PAYMENTS TO SUBCONTRACTORS:** Contractor shall comply with the provisions of applicable laws and regulations relating to Contractor's relations with Subcontractors. Payments by Contractor to Subcontractors associated with the Town of Addison Contracts are subject to the time periods established in the Texas "Prompt Payment Act", contained in Chapter 2251 of the Texas Government Code.

All persons employed in the performance of the Work under the Contract, or any subcontracts hereunder, shall be paid not less than the general rates of per diem, holiday, and overtime wages prevailing in the locality of the Work of a similar character as detailed in the Special Provisions. Failure to comply with this provision shall subject Contractor to the penalties prescribed in Chapter 2258 of the Texas Government Code, as amended.

Contractor will include in each subcontract for material or services entered into by Contractor and a Subcontractor, including a supplier, for purposes of performing the Work under the Contract a payment clause that obligates Contractor to pay the Subcontractor for satisfactory performance under its subcontract within seven (7) days out of such amounts as are paid to Contractor by the Town of Addison under the Contract. A false certification to the Town of Addison under the provisions of the Payments clause may be a principal offense in violation of Section 37.10 of the Texas Penal Code.

67. **USE OF COMPLETED PORTIONS OF THE WORK:** Whenever, as determined by the Town of Addison, any portion of the Work performed by Contractor is in a condition suitable for use, and the best interests of the Town of Addison requires such use the Town of Addison may take possession of or use such portion of the Work. Such use by the Town of Addison shall in no case be construed as final acceptance, and shall neither relieve Contractor of any of its responsibilities under the Contract, nor act as a waiver by the Town of Addison of any of the conditions thereof. Contractor shall not be liable for the cost of repairs, rework, or renewals, which may be required due to ordinary wear and tear resulting from such use. However, if such use increases the cost or delays the completion of remaining portions of the

Work, Contractor shall notify the Town of Addison in writing as required by the Contract and may be entitled to such additional compensation or extension of time, or both, as determined in accordance with the Contract.

If in the course of such use, the Work proves to not be in compliance with the Contract, the Town of Addison shall have the right to continue such use until such portion of the Work can, without injury to the Town of Addison, be taken out of service for correction of defects, errors, omissions, or replacement of unsatisfactory materials, as necessary for such portions of the Work to comply with the Contract. Contractor shall correct the Work as soon as practical, but not later than one (1) month after notification by the Town of Addison.

Contractor shall not use any permanently incorporated materials unless such use is approved in writing by the Town of Addison. Where Contractor's request is granted for the use of certain materials, Contractor shall properly use and maintain and, upon completion of its use and at its own expense, recondition such materials to the satisfaction of the Town of Addison.

68. **COMPLETE AGREEMENT:** The Contract Documents (including Attachments, the Special Provisions, other documents and manuals incorporated herein) is the full and complete agreement between the Town of Addison and Contractor with respect to the subject matter herein and supersedes any and all prior agreements between the parties hereto.

69. **WAIVER:** The waiver by the Town of Addison of a breach of any provision of the Contract by Contractor shall in no way impair the right of the Town of Addison to enforce the provision for any subsequent breach thereof. All remedies provided hereunder are cumulative and are in addition to all other remedies available at law or in equity.

70. **EXECUTION OF THE CONTRACT:** The Contract may be executed in multiple counterparts, each of which shall, for all purposes, be deemed an original but which together shall constitute one and the same instrument, and the signature pages from any counterpart may be appended to any other counterpart to assemble fully executed documents, and counterparts of the Contract may also be exchanged via electronic facsimile machines and any electronic facsimile of any party's signature shall be deemed to be an original signature for all purposes.

71. **DEFINITIONS:** The following definitions are added to the General Provisions and Special Provisions:

OFFEROR: Any person, persons, partnership, company, firm, association, or corporation acting directly or through a duly authorized representative submitting a proposal for the work contemplated.

PROJECT: The Town of Addison's overall objective and endeavor of which the Contract forms a part and ultimately creates, which encompasses all Contact Documents constructed to final completion and final acceptance.

ARCHITECT: The design Architect of record is Brien Graham, AIA (Texas Registered Architect #27834) with LPA, Inc. located at 1801 N. Lamar Street, #150, Dallas, TX 75202.

72. **<u>CONTRACTOR REPRESENTATIONS</u>:** By entering into the Contract, the Contractor makes the following representations to the Town of Addison:

A. Contractor has examined and carefully studied the Proposal Documents and the related data identified in the Proposal Documents.

B. The Contractor has visited the Project site where the goods are to be installed or services will be provided and become familiar with and is satisfied as to the observable local conditions that may affect cost, progress, or the furnishing of goods and services, if required to do so by the Proposal Documents, or if, in the Contractor's judgment, any local condition may affect cost, progress, or the furnishing of goods and services.

C. The Contractor is familiar with and is satisfied as to all Laws and Regulations in effect as of the date of the proposal that may affect cost, progress, and the furnishing of goods and services.

D. The Contractor has carefully studied, considered, and correlated the information known to the Contractor; information commonly known to sellers of similar goods doing business in the locality of the Project site where the goods will be installed or where services will be provided; information and observations obtained from the Contractor's visits, if any, to the Project site where the goods will be installed or services will be provided; and any reports and drawings identified in the Proposal Documents regarding the Project site where the goods will be installed or where services will be provided, with respect to the effect of such information, observations, and documents on the cost, progress, and performance of the Contractor's obligations under the Proposal Documents. Contractor acknowledges and accepts that this Project will require Urban Construction Methods and Restriction that will minimize noise, dust and vibration during the work and limited access and work area is available.

E. The Contractor has given the Engineer written notice through the Pre-Bid Question process of all conflicts, errors, ambiguities, and discrepancies that the Contractor has discovered in the Proposal Documents, and the written resolution (if any) thereof by the Engineer is acceptable to the Contractor.

F. The Proposal Documents are generally sufficient to indicate and convey understanding of all terms and conditions for furnishing the goods and services for which the proposal is submitted.

G. The Contractor acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of proposals, and final payment for all unit price

pay items will be based on actual field measured quantities, determined as provided in the Contract Documents. The Contractor also acknowledges that each unit price includes an amount considered by the Contractor to be adequate to cover theContractor's overhead and profit for each separately identified item.

73. **PAY ITEMS/REFERENCE SPECIFICATIONS:** The requirements of NCTCOGstandard specifications for Public Works construction 5th Edition dated 2017 and the Town of Addison and other referenced specifications shall apply as described.

74. **NO BOYCOTT ISRAEL:** Pursuant to Texas Government Code Chapter 2270, Contractor's execution of this Agreement shall serve as verification that the Contractor does not presently boycott Israel and will not boycott Israel during the term of this Agreement.

75. **DISPOSAL OF SURPLUS MATERIAL**

Surplus material not required for other parts of the work and not otherwise specifically covered by the drawings or specifications shall become the property of the Contractor for proper disposal by them.

SP.4 **REMOVING OBSTRUCTIONS**

Existing driveways, mailboxes, fences, sidewalks, landscaping, signs, and RCP or CMP drainage pipes and other existing improvements shall be removed and replaced where necessary. The Contractor shall replace existing obstructions with equal or better materials.The Contractor shall coordinate any removal with the Property Owner.

SECTION PS

PROJECT SIGN

PROJECT SIGN

1. Quantity

One (w) Project Designation signs will be constructed and installed on the project site as directed by the Owner. It will be the responsibility of the Contractor to maintain the sign in a presentable condition at all times during construction. Maintenance will include painting and repairs as directed by the Town or its appointee. The locations for sign placement shall be coordinated with the Town prior to construction and prior to the commencement of each phase.

2. Material

Sign shall be constructed of ¾-inch thick smooth finish fir plywood (Grade A-C, exterior or better).

Sign will be securely mounted to 4" x 4" square posts. Nuts and bolts will not protrude from face of sign. Posts will be mounted to a support system that will provide adequate stabilization to ensure the sign will not fall over in heavy winds. Sandbags or other techniques may be necessary to protect sign. No other signage or attachments shall be placedon the Project Sign.

3. Dimensions

Size of sign will be four feet tall and six feet wide. The height and arrangement of the lettering shall be in accordance with the attached detail.

4. Paint

Sign will be one-sided and will have a white and blue background, as noted on the drawing. Text will be black, except for the word "Addison!" which will be a blue color approved by the Town Representative. The back of the sign shall be painted White. The posts and support members shall be painted white. The paint will be an outdoor paint and will be maintained throughout the project in proper order. The quality of the paint, painting, and lettering on the signs shall be approved by the Town Representative prior to sign being fabricated.

5. Payment

Project Signs will **not** be a separate pay item and are included in Pay Item I-3, Site Preparation. This will include all labor, equipment, tools, and incidentals necessary to complete, install and maintain the sign throughout the project.

Please Pardon the Temporary Inconvenience During Construction

ADDISON ATHLETIC CLUB RENOVATIONS

(Your Bond Funds at Work)

Scheduled Completion: XXXX 20XX

Contractor: XXXXXXXXXXXXXXXX

A Town of Addison Project

For Additional Information: Call (972) 450 - 2851

Or Visit: https://addisontexas.net/projects

Color for signs are as follows:

BLUE
CMYK: 80-8-0-0
HEX: 4DA6DE
RGB: 77-166-222
PMS: 2995

INSRUANCE REQUIREMENTS

INSURANCE AND IMDEMNIFICATION ACKNOWLEDGEMENT FORM

TOWN OF ADDISON, TEXAS

ADDISON ATHLETIC CLUB RENOVATIONS PROJECT

REQUIREMENTS

Contractors performing work on TOWN OF ADDISON property or public right-of-way shall provide the TOWN OF ADDISON a certificate of insurance or a copy of their insurance policy(s) (and including a copy of the endorsements necessary to meet the requirements and instructions contained herein) evidencing the coverages and coverage provisions identified herein within ten (10) days of request from TOWN OF ADDISON. Contractors shall provide TOWN OF ADDISON evidence that all subcontractors performing work on the project have the same types and amounts of coverages as required herein or that the subcontractors are included under the contractor's policy. Work shall not commence until insurance has been approved by TOWN OF ADDISON.

All insurance companies and coverages must be authorized by the Texas Department of Insurance to transact business in the State of Texas and must have a A.M. Best's rating A-VII or greater.

Listed below are the types and minimum amounts of insurances required and which must be maintained during the term of the contract. TOWN OF ADDISON reserves the right to amend or require additional types and amounts of coverages or provisions depending on the nature of the work.

TYPE OF INSURANCE	AMOUNT OF INSURANCE	PROVISIONS
1. **Workers' Compensation Employers' Liability** to include: (a) each accident (b) Disease Policy Limits (c) Disease each employee	Statutory Limits per occurrence Each accident $1,000,000 Disease Policy Limits $1,000,000 Disease each employee$1,000,000	**TOWN OF ADDISON, and LPA, Inc. to be provided a *WAIVER OF SUBROGATION AND 30 DAY NOTICE OF CANCELLATION or*** material change in coverage. **Insurance company must be A-VII rated or above.**
2. **Commercial General (Public) Liability** to include coverage for: a) Bodily Injury b) Property damage c) Independent Contractors d) Personal Injury e) Contractual Liability	Bodily Injury/Property Damage per occurrence $1,000,000, General Aggregate $2,000,000 Products/Completed Aggregate $2,000,000, Personal Advertising Injury per occurrence $1,000,000, Medical Expense 5,000	**TOWN OF ADDISON, and LPA, Inc. *to be listed as ADDITIONAL INSURED and provided 30 DAY NOTICE OF CANCELLATION* or material change in coverage.** **Insurance company must be A-VII rated or above.**
3. **Business Auto Liability** to include coverage for: a) Owned/Leased vehicles b) Non-owned vehicles c) Hired vehicles	Combined Single Limit $1,000,000 per occurrence for bodily injury and property damage	**TOWN OF ADDISON, and LPA, Inc. *to be listed as ADDITIONAL INSURED and provided 30 DAY NOTICE OF CANCELLATION* or material change in coverage.** **Insurance company must be A-VII rated or above.**
4. **Umbrella or Excess Liability Policy over Commercial General Liability and Automobile Liability limits of $1 million per occurrence**	Minimum $4 million per occurrence excess $1 million underlying per occurrence	**TOWN OF ADDISON, and LPA, Inc. *to be listed as ADDITIONAL INSURED and provided 30 DAY NOTICE OF CANCELLATION* or material change in coverage.** **Insurance company must be A-VII rated or above.**

Certificate of Liability Insurance forms (together with the endorsements necessary to meet the requirements and instructions contained herein)may be **faxed** to the Purchasing Department: **972-450-7074 or emailed to: purchasing@addisontx.gov.** Questions regarding required insurance should be directed to the Purchasing Manager.

With respect to the foregoing insurance,

1. All liability policies shall contain no cross liability exclusions or insured versus insured restrictions applicable to the claims of the Town of Addison.

2. All insurance policies shall be endorsed to require the insurer to immediately notify the Town of Addison, Texas of any material change in the insurance coverage.

3. All insurance policies shall be endorsed to the effect that the Town of Addison, Texas will receive at least thirty (30) days' notice prior to cancellation or non-renewal of the insurance.

4. All insurance policies, which name the Town of Addison and **LPA, Inc.**as an additional insured, must be endorsed to read as primary coverage regardless of the application of other insurance.

5. Insurance must be purchased from insurers that are financially acceptable to the Town of Addison and licensed to do business in the State of Texas.

All insurance must be written on forms filed with and approved by the Texas Department of Insurance. Upon request, Contractor shall furnish the Town of Addison with complete copies of all insurance policies certified to be true and correct by the insurance carrier.

This form must be signed and returned with your quotation. You are stating that you do have the required insurance and if selected to perform work for TOWN OF ADDISON, will provide the certificates of insurance (and endorsements) with the above requirements to TOWN OF ADDISON within 10 working days.

A CONTRACT/PURCHASE ORDER WILL NOT BE ISSUED WITHOUT EVIDENCE AND APPROVAL OF INSURANCE.

AGREEMENT

I agree to provide the above described insurance coverages within 10 working days if selected to perform work for TOWN OF ADDISON. I also agree to require any subcontractor(s) to maintain insurance coverage equal to that required by the Contractor. It is the responsibility of the Contractor to assure compliance with this provision. The Town accepts no responsibility arising from the conduct, or lack of conduct, of the Subcontractor.

Project/Bid# Parks and Recreation Department Proposal 21-125, Addison Athletic Club Renovations

Company: Northridge Construction Group, LLC

Printed Name: Matt Tucker

Signature: _____ **Date:** 08/19/2021

DOCUMENT 00 2600

PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 01 2500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

A. 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.

1.3 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
   1. Extensive revisions to the Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
   3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:
   1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
   2. Submittal Format: Submit three copies of each written Procurement Substitution Request, using form bound in Project Manual.
   3. Submittal Format: Submit Procurement Substitution Request, using format provided on Project Web site.
      a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
      b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
         1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
         2) Copies of current, independent third-party test data of salient product or system characteristics.
         3) Samples where applicable or when requested by Architect.
         4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. 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.
         5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
         6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.

7) 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, which will become necessary to accommodate the proposed substitute.

c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.

d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:

1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT

SECTION 00 2600A

SUBSTITUTION REQUEST FORM

PROJECT: _____ **(Before Contract Award)**

TO: _____ _____

NO._____ DATE: _____

Contractor hereby requests acceptance of the following product or system as a substitution in accordance with provisions of Division 01 Section "Substitution Procedures:"

1. SPECIFIED PRODUCT OR SYSTEM

Substitution request for: _____

Specification Section No.: _____ Article/ Paragraph: _____

2. REASON FOR SUBSTITUTION REQUEST

SPECIFIED PRODUCT . . .

- ☐ Is no longer available.
- ☐ Is unable to meet project schedule.
- ☐ Is unsuitable for the designated application.
- ☐ Cannot interface with adjacent materials.
- ☐ Is not compatible with adjacent materials.
- ☐ Cannot provide the specified warranty.
- ☐ Cannot be constructed as indicated
- ☐ Cannot be obtained due to one or more of the following:
  - ☐ Strike
  - ☐ Lockout
  - ☐ Bankruptcy of manufacturer or supplier
  - ☐ Similar occurrence (explain below)

PROPOSED PRODUCT . . .

- ☐ Will reduce construction time
- ☐ Will result in cost savings of $ _____ to Project
- ☐ Is for supplier's convenience
- ☐ Is for subcontractor's convenience
- ☐ Other: _____ _____

3. SUPPORTING DATA

- ☐ Drawings, specifications, product data, performance data, test data, and any other necessary information to facilitate review of the Substitution Request are attached.
- ☐ Sample is attached.
- ☐ Sample will be sent if requested.

4. QUALITY COMPARISON: Provide all necessary side-by-side comparative data as required to facilitate review of Substitution Request:

	SPECIFIED PRODUCT	PROPOSED PRODUCT
Manufacturer:	_____	_____
Name / Brand:	_____	_____
Catalog No.:	_____	_____
Vendor:	_____	_____
Variations:	_____	_____

(Add Additional Sheets If Necessary)

Local Distributor or Supplier: _____

Maintenance Service Available: ☐ Yes ☐ No

Spare Parts Source: _____

Warranty: ☐ Yes ☐ No _____ Years

5. PREVIOUS INSTALLATIONS

Identification of at least three similar projects on which proposed substitution was used:

PROJECT #1:_____

Address:_____

Architect:_____

Owner:_____

Contractor:_____

Date Installed: _____

PROJECT #2: _____

Address:_____

Architect:_____

Owner:_____

Contractor:_____

Date Installed: _____

PROJECT #3: _____

Address: _____

Architect: _____

Owner: _____

Contractor: _____

Date Installed: _____

6. EFFECT OF SUBSTITUTION

Proposed substitution affects other work or trades: ☐ No ☐ Yes (if Yes, explain)

_____

_____

Proposed substitution requires dimensional revisions or redesign of architectural, structural, M-E-P, life safety, or other work: ☐ No ☐ Yes (if Yes, attach data explaining revisions)

7. STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS

Contractor and Subcontractor have investigated the proposed substitution and hereby represent that:

A. They have personally investigated the proposed substitution and believe that it is equal to or superior in all respects to specified product, except as stated above;
B. The proposed substitution is in compliance with applicable codes and ordinances;
C. The proposed substitution will provide same warranty as specified for specified product;
D. They will coordinate the incorporation of the proposed substitution into the Work, and will include modifications to the Work as required to fully integrate the substitution;
E. They have included complete cost data and implications of the substitution (attached);
F. They will pay any redesign fees incurred by the Architect or any of the Architect's consultants, and any special inspection costs incurred by the Owner, caused by the use of this product;
G. They waive all future claims for added cost or time to the Contract related to the substitution, or that become known after substitution is accepted.
H. The Architect's approval, if granted, will be based upon reliance upon data submitted and the opinion, knowledge, information, and belief of the Architect at the time decision is rendered and Addendum is issued; and that Architect's approval therefore is interim in nature and subject to reevaluation and reconsideration as additional data, materials, workmanship, and coordination with other work are observed and reviewed.

Contractor: _____

(Name of Contractor)

Date: _____ By: _____

Subcontractor: _____

(Name of Subcontractor)

Date: _____ By: _____

Note: Unresponsive or incomplete requests will be rejected and returned without review.

8. ARCHITECT'S REVIEW AND ACTION

☐ Substitution is accepted.

☐ Substitution is accepted, with the following comments: _____

_____

☐ Resubmit Substitution Request:

☐ Provide more information in the following areas: _____

_____

☐ Provide proposal indicating amount of savings / credit to Owner
☐ Bidding Contractor shall sign Bidder's Statement of Conformance
☐ Bidding Subcontractor shall sign Bidder's Statement of Conformance

☐ Substitution is not accepted:

☐ Substitution Request received too late.
☐ Substitution Request received directly from subcontractor or supplier.
☐ Substitution Request not submitted in accordance with requirements.
☐ Substitution Request Form is not properly executed.
☐ Substitution Request does not indicate what item is being proposed.
☐ Insufficient information submitted to facilitate proper evaluation.
☐ Proposed product does not appear to comply with specified requirements.
☐ Proposed product will require substantial revisions to Contract Documents.

By: _____ Date: _____

Architect has relied upon the information provided by the Contractor, and makes no claim as to the accuracy, completeness, or validity of such information. If an accepted substitution is later found to be not in compliance with the Contract Documents, Contractor shall provide the specified product.

END OF FORM

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DOCUMENT 00 3132

GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. A geotechnical investigation report for Project, prepared by Fugro South, Inc., dated January 31, 2021, is available for viewing as appended to this Document.

1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT 00 3132

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GEOTECHNICAL INVESTIGATION

ADDISON ATHLETIC CLUB EXPANSION 2000
3900 BELTWAY
ADDISON, TEXAS

PROJECT NO. 0701-1049

Report to:

BUILDINGS SOLUTIONS
DALLAS, TEXAS

APRIL 2001

FUGRO SOUTH, INC.

2880 Virgo Lane
Dallas, Texas 75229
Tel : 972-484-8301
Fax : 972-620-7328

Report No. 0701-1049
April 26, 2001

Mr. Howard Hollinger
Building Solutions
Owner's Representative / Construction Manager
9304 Forest Lane, Suite 107
Dallas, Texas 75243

Geotechnical Investigation
Addison Athletic Club Expansion 2000
Addison, Texas

Dear Mr. Hollinger:

This report presents the results of the geotechnical investigation performed at the site for the above referenced project in Addison, Texas. This study was performed in general accordance with our proposal number P0701-1049, dated January 31, 2001.

Our engineering analysis as well as the results of the field and laboratory investigations are included in this report. We appreciate the opportunity to be of assistance on this project. Please feel free to contact us if you have any questions or when we may be of further service for the professional materials testing and inspection services that will be required during the construction phase of the project.

Very truly yours,

FUGRO SOUTH, INC.

STATE OF TEXAS
HUGH T. KELLY
69649
LICENSED
PROFESSIONAL ENGINEER

Hugh T. Kelly, P.E.
Senior Geological Engineer

Saad M. Hineidi, P.E.
Senior Vice President

HTK/SMH/kp
Copies submitted: (4)

CONTENTS

ILLUSTRATIONS

APPENDIX

GEOTECHNICAL INVESTIGATION
ADDISON ATHLETIC CLUB EXPANSION 2000
ADDISON, TEXAS

INTRODUCTION

Project Description

The project is to construct an athletic facility building, a swimming pool, parking, and associated earthwork, including berms. The building will be a two-story masonry structure. The column loads expected to be typical of similar structures. The facility is located in Addison, Texas. The general location of the site is shown on Plate A.

Site Description

At the time of this investigation, the site is a manicured landscaped area with grass, shrubs, and scattered tress. There are concrete walks, landscape berms, and tennis courts. Based on visual observation, the site topography is relatively flat.

Scope of Work

The purpose of this investigation was to:

1) Develop soil and rock stratigraphy at the boring locations.
2) Evaluate soil swell potential.
3) Recommend foundation design parameters.
4) Estimate uplift loads on drilled piers due to expansive clays.
5) Provide site preparation recommendations.
6) Provide guidelines for pavement design.

Report Format

The first sections of the report describe the field and laboratory phases of the study. The remaining sections present our recommendations to guide design and preparation of plans and specifications. Boring logs and laboratory test results are presented in the report **Illustrations**.

FIELD INVESTIGATION

A total of six borings were drilled and sampled to explore the subsurface conditions at the referenced site. Borings B-1 through B-4 were drilled to depths of 16 to 25 feet below existing grade for the proposed buildings and swimming pool. Borings B-5 and B-6 were drilled to depths of 5 feet below grade in the parking lot areas. The locations of the borings are shown on Plate B. Logs of the borings with descriptions of the soils sampled are presented on Plates 1 through 6. Keys to the terms and symbols used on the boring logs are presented on Plates 7 and 8. The stratigraphy (soil/rock strata boundaries) shown on the boring logs are approximate.

The borings were advanced using a truck-mounted drill rig. Undisturbed cohesive soil samples were obtained using 3-inch diameter thin-walled tube samplers that were pushed into the soil. The undrained compressive strength of cohesive soils was estimated in the field using a calibrated pocket penetrometer.

Representative samples of the subsurface materials were also obtained by employing split-spoon sampling procedures (ASTM D 1586). The 2-inch O.D. split-spoon sampler was first seated 6 inches and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the final foot was recorded and is designated the "standard penetration resistance." In very dense soils, the sampler is driven a few inches into such materials and the penetration resistance is expressed as the number of hammer blows for the depth of penetration, e.g. 50/3".

Texas Highway Department Cone Penetration Tests were performed in the field to examine the resistance of rock-like materials to penetration. A 3-inch diameter steel cone driven by a 170-pound hammer dropped 24 inches is the basis for Texas Department of Highways and Public Transportation strength correlations. Depending on the resistance of the materials, either the number of blows of the hammer required to provide 12 inches of penetration, or the inches of penetration of the cone due to 100 blows of the hammer are recorded on the field log included in this report.

The borings were advanced using dry auger procedures. This allows for observation of the subsurface water level at the time of exploration. These water level observations are recorded on the boring logs. Upon completion of the field investigation, the borings are backfilled with drill cuttings. All soil samples were extruded from the samplers in the field, visually classified, and wrapped to prevent loss of moisture or disturbance during transfer to the laboratory.

LABORATORY TESTING

General

Laboratory tests were performed to partially define pertinent engineering characteristics of the soil and rock encountered. The laboratory tests included moisture content, visual classification, liquid and plastic limit, and free swell.

Classification Tests

Classification of soils was verified by natural moisture content determinations, plasticity determinations. These tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Procedures. The results of the liquid and plastic limits determinations and moisture content are shown on the boring logs.

Free Swell Tests

A selected sample of the near-surface cohesive soils was subjected to free swell testing. In the free swell test, a sample is placed in a consolidometer and subjected to the estimated overburden pressure. The sample is then inundated with water and allowed to swell. Moisture contents are determined both before and after completion of the test. The results are recorded as the percent swell, with initial and final moisture content. The free swell test result is shown on Plate 9.

Summary

Descriptions of strata made in the field at the time the borings were drilled were modified in accordance with results of laboratory tests and visual examination in the laboratory. All recovered soil samples were examined, classified and described in general accordance with ASTM D 2487-85, ASTM D 2488-84 and Unified Soil Classification procedures. Classification of the soils and descriptions of soil strata are shown on the attached boring logs.

GENERAL SUBSURFACE CONDITIONS

Stratigraphy

Geologically, the site is located within the Austin Chalk (AC) geologic formation. Based on our interpretation of the borings drilled for this study, the subsurface stratigraphy consists of reworked site soils and in-situ native soil over tan, weathered limestone. The site soils, native or reworked, are brown, clays, containing some limestone fragments from the parent rock formation, are of medium plasticity, and slightly to moderately expansive. Gray, fresh (unweathered) limestone of the AC formation underlies the tan, weathered limestone.

The following table summarizes the soil/rock stratigraphy encountered at the boring locations drilled at the project site:

Boring No.	Depth to tan, weathered limestone (feet)	Depth to gray, fresh limestone (feet)	Boring Total Depth (feet)	Depth to groundwater (feet)
B-1	4	17	25	NE
B-2**	6	14	25	NE
B-3	6	9	20	NE
B-4	2.5	6.5	16	NE
B-5*	1.5	NE	5	NE
B-6*	1	NE	5	NE

**Borings drilled within the proposed pavement area.*
NE – Not encountered in the total boring depths.
***Seepage occurred at a depth of 7 feet.*

Groundwater Conditions

The borings were advanced using continuous flight auger methods. Advancement of the borings using this drilling equipment and these methods allows observation of initial zones of seepage. At the time of this investigation, groundwater seepage was not encountered, except for minor seepage in Boring B-2 at a depth of 7 feet. It is virtually impossible to accurately predict the magnitude of subsurface water fluctuations that might occur in perched conditions in the geologic formation. The groundwater conditions are subject to change with variations in climatic conditions. It is not uncommon to detect groundwater seepage at the interface between the clay and the limestone bedrock or within the naturally occurring cracks and fissures within the tan weathered limestone stratum. Future construction activities may alter the surface and subsurface drainage characteristics of this site. Therefore, if notable changes from the conditions are observed prior to

or during construction, this office should be notified immediately to review the effect on the design recommendations.

ANALYSIS AND RECOMMENDATIONS

Soil Movement

The overburden clays encountered in the borings exhibited plasticity indices (PI) ranging from 21 to 35. These clays are moderately expansive and are capable of significant vertical movements with changes in moisture conditions. The calculated Potential Vertical Rise (PVR) uses TxDOT Test Method Tex-124-E. The PVR or maximum magnitude of the moisture induced vertical upward movement using the approximate current dry moisture conditions is two inches. Method Tex-124-E is based on a comparison of classification tests to swell tests performed for TxDOT. Classification tests from this investigation are then used in an empirical method to determine PVR. This better represents potential maximum movements. Swell test results and penetrometer readings indicate similar probable swell. Swell tests provide data based on the existing moisture profile of the subsurface soils at the time of exploration.

Foundation Type

Based on these geotechnical findings, we recommend that the structural loads for the proposed buildings be supported by auger excavated, straight-sided, cast-in-place, reinforced concrete piers. These piers should be founded at least 7 feet into intact, tan, weathered limestone or 2 feet into the underlying fresh gray limestone, whichever occurs first. The pier dimensions can be designed using a net allowable end bearing pressure of 34,000 pounds per square foot. The allowable skin friction will vary with weathering. A skin friction value of 2,200 pounds per square foot (psf) is applicable in weathered limestone. A skin friction value of 5,500 psf is applicable to fresh, gray limestone. The skin friction component should only be applied to the portion of the shaft founded in intact limestone, one shaft diameter above the pier tip and below the bottom of any temporary casing. The uplift tension forces caused by expansive near surface soils will be resisted by the skin friction generated by the contact of the concrete pier and the weathered and fresh gray limestone. The magnitude of this skin friction is on the order of 1,800 pounds per square foot of shaft area in direct contact with the limestone.

The piers should be provided with sufficient steel reinforcement to resist the expansive soil uplift pressures, in addition to any other tensional loading. These pressures are approximated to be

on the order of 900 pounds per square foot of shaft area over the upper 4 feet of the shaft. Foundation piers designed and constructed in accordance with the information provided in this report will have a factor of safety in excess of 3.0 against shear type failure, and will experience negligible settlement upon initial loading. A reduction of the allowable bearing pressures will be required if the piers are placed closer than 2 pier diameters, edge to edge.

Pier Construction

The construction of all piers should be observed by experienced geotechnical personnel during construction to assure compliance with design assumptions and to verify: (1) the bearing stratum; (2) the minimum depth; (3) the removal of all smear zones and cutting; (4) that groundwater seepage, if encountered, is correctly handled; and (5) that the shafts are within the acceptable vertical tolerance.

Reinforcing steel and concrete should be placed as soon as possible after the excavation is completed. In no event should a pier excavation be allowed to remain open for more than 8 hours. Concrete placed in excavations in excess of 10 feet deep should be placed through a tremie to prevent segregation of the aggregates.

Grade Beams

Grade beams should be structurally connected into the top of the piers. A void space of 6 inches should be provided beneath them. This void space allows movement of the soils below the grade beams without distressing the structural system. Structural cardboard forms are typically used to provide this void beneath grade beams. Cardboard forms must have sufficient strength to support the concrete grade beams during construction.

Our experience indicates that major distress in grade beams will occur if the integrity of the void box is not maintained during and after construction. The excavations for the void boxes must remain dry. Cardboard cartons can easily collapse during concrete placement if the cardboard becomes wet. Backfill material must not be allowed to enter the carton area below grade beams, since this reduces the void space which underlying soils need to swell.

The exterior portions of the grade beams along the perimeter of the building should be carefully backfilled with on-site clayey soils. The backfill soils should be placed at a moisture content between optimum moisture content and 5 percentage points above optimum. The fill should be

compacted to 95 percent of its maximum dry density as determined in accordance with ASTM D 698 (standard Proctor).

Floor System

As previously mentioned, the overburden soils are moderately expansive. These soils are capable of upward or downward movement with changes in moisture conditions. This behavior is often described as shrink/ swell behavior. For these types of soils, a structural floor system is the option that provides the least-likelihood of post-construction movement. With this system, the ground floor is structurally suspended on the drilled shaft piers above a minimum void. Voids of at least 6 inches are common. However, experience in this geologic environment has shown ground-supported floor slabs to be a suitable alternative. The geotechnical data for this phase of the overall project supports this alternative. It should be understood by all parties that a soil-supported foundation system would experience some movement with time.

If one inch of total vertical slab movement can be tolerated, the slabs must be constructed on a modified subgrade. Ground modification should include placing the reinforced concrete floor slabs on a minimum of 24 inches of select fill. This recommendation assumes the select fill is placed at current grades. If an elevated grade is required, only select fill should be used to raise the grade. If cut is required to achieve the desired grade, removal of the site clays and replacement with the recommended select fill will further reduce probable post construction vertical slab movement. If grading cuts into tan limestone, nearly all movement will be eliminated. However, due to practical construction techniques and soil theory, the slab should be designed for not less than ½ inch movement. To help assure adequate performance, the subgrade will require modification, construction supervision, and maintaining proper drainage around the structures during and after construction.

With recommendations contained in this report, the differential movements between the grade beams and the floor slab may approach one-inch. In areas where it will be difficult or impractical to float the slab, this differential movement should be considered in the concrete and steel design for the slab.

A moisture barrier of polyethylene sheeting or similar material should be placed between all ground slabs and the subgrade to retard moisture migration through the slab. The exterior portions of the grade beams along the perimeter of the ground slabs should be backfilled with on-site soils. The backfill soils should be placed at a moisture content between optimum and 5

percentage points above optimum. The backfill should be compacted between 95 and 100 percent of its maximum dry density as determined in accordance with ASTM D-698 (standard Proctor).

Swimming Pool

Because the swimming pool excavation will be into limestone, soil/structure interaction difficulties will be minimized. The weight of the pool walls loaded with water will be less than the weight of the material removed from the excavation; therefore, bearing capacity considerations are satisfied. Differential movements due to leaking conditions will be at a minimum in limestone. Standard wall design and reinforcing should be sufficient. Lateral hydrostatic pressures will be balanced on the pool walls. The pool designer should base the final design on the geotechnical criteria described throughout this report.

Flat Work Consideration

We recommend that all access and entryway slabs be supported on a minimum of 6 inches of select fill. Differential upward movement of all ground-supported slabs should be anticipated and considered during the design of the grading plan. Sidewalks, entry slabs, pavements, etc., should not be structurally tied to the buildings.

Lateral Earth Pressures

By design, the below-grade walls should be relatively rigid and will not allow significant lateral movement. Therefore, the below-grade walls will be subjected to at-rest lateral earth pressures. The magnitude of the lateral pressures will depend on the type of soil that is being retained. Water pressure for the full height of the walls need to be included in design calculations with the water level at the ground surface. The equivalent fluid pressures (triangular distribution) for soil backfills with water pressure included are presented in the following table.

At-Rest Lateral Earth Pressure Values

Soil Type	Design Dry Density pcf	At-Rest Pressure	
		Lateral Earth Pressure Coefficient	Equivalent Fluid Pressure with Hydrostatic Loading psf/ft
Compacted Granular Backfill [1]	100	0.38	101
Compacted Non-Expansive Fill	100	0.58	121
On-Site Clays	100	0.76	138
Limestone (intact)	137	0.15	83

[1] Granular material shall be an angular crushed stone with less than 5% passing the number 200 sieve.

All surcharge loads should be multiplied by the respective lateral earth pressure coefficient and added to the equivalent fluid pressure to determine the total lateral earth pressures acting on the below-grade walls.

Where select fill or granular fill is used, caution should be exercised not to over compact the backfill. Over compaction will result in excessive lateral earth pressures. Hand-operated tampers or other lightweight compactors are preferred in the area adjacent to the wall. The lift thickness should be reduced to 4 inches for those areas where hand-operated compactors are required.

Excavation

The side slopes of excavations through the overburden soils should be made in such a manner to provide for their stability during construction. Excavation of the limestone will require rock ripping, breaking, or similar equipment. The shear strength of the limestone often exceeds 2000 pounds per square inch (psi). Structures, utility lines or facilities, which are constructed prior to or during the proposed construction, should be protected from loss of end bearing or lateral support.

Trench safety recommendations are beyond the scope of this study. The contractor must comply with all applicable safety regulations concerning trench safety and excavations, including, but not limited to, OSHA regulations.

Site Preparation/Fill

In general, site preparation should include necessary stripping of the vegetation from the building pad area prior to placement of any additional fill materials. The site should be further cut to an elevation that allows placement of the required select fill and the floor slab. The site may be filled to grade, berms constructed, and like grading work using on-site suitable fill. The on-site clays and excavated limestone, free from deleterious matter, may be used. Excavated limestone shall be processed to a maximum size of 4-inches for such purposes. Fill materials should be placed in six (6) to eight (8)-inch loose lifts at moisture contents between optimum and 5 percentage points above optimum or within 3 percent of optimum for select fill. Each lift must be compacted from 95 and 100 percent of its maximum dry density as defined in ASTM D 698. Field density test should be taken at the rate of one test per each 5,000 square feet, per lift, in the area of all compacted fills. For areas where hand tamping is required, the testing frequency should be increased to approximately one test, per lift, per 100 linear feet of area.

Select Fill

Select fill, as referred to in the report should consist of clayey sands free of organic materials and have a plasticity index from 6 to 15, a liquid Limit of 40 or less, and have from 20 to 45 percent particles passing a No. 200 sieve. Placement and compaction of the select fill should be performed in accordance with the *Site Preparation* section of this report. It is preferable to place the select fill above the surrounding ground surface. The select fill should not extend beyond the outside perimeter of the building. A provision of a subsurface drainage system should be considered in areas where the select fill is placed below the surrounding ground surface, particularly in areas where drainage may be problematic.

Additional Design Consideration

The following information has been assimilated after examination of numerous projects constructed in similar soils throughout the area. If these features are incorporated in the overall design of the project, the performance of the structure will be improved.

1. Special consideration should be given to completion of flatwork and related items outside the building areas (such as stairs, sidewalks, signs, and utility connections). These should be adequately designed to accommodate the potential ground movements described above.

2. Sidewalks should not be structurally connected to the building. These should be sloped away from the building so that water will drain away from the structure. All joints between the structure and adjoining flatwork should be sealed to minimize the potential for infiltration of surface water.

3. Roof drainage should be collected by a system of gutters and downspouts and transmitted by pipe to a storm drainage system or to a paved surface where the water can drain away without entering the building subgrade.

4. The parking areas, drives, and the general ground surface should be sloped away from the buildings on all sides so that surface water will always drain away from the structure. The exterior surface should slope away from the buildings at a slope preferably from 10 and 20 horizontal to 1 vertical. Water should not be allowed to pond near buildings or pavements.

5. Every attempt should be made to limit the extreme wetting or drying of the subsurface soils since swelling and shrinkage will result. Standard construction practices of providing good surface water drainage should be used. A positive slope of the ground away from the foundation and ditches or swales provided to carry off the runoff water both during and after construction is necessary.

6. Backfill for utility lines or along the perimeter grade beams should consist of a well-compacted, impermeable, on-site clay to minimize the potential for localized infiltration of surface water. The trench excavation floor should sloped away from the structure. If the backfill is too dense or too dry, swelling may form a mound over a backfilled utility line. If the backfill is too loose or too wet, settlement may form a low area along the line. Either case is undesirable since several inches of movement is possible and excessive movement or cracking of soil-supported flatwork are likely to result. The clays should be processed and moisture conditioned using the previously discussed compaction criteria. Where the utility lines pass beneath pavements, the top 6 inches should be compacted similarly to the remainder of the subgrade. It is also recommended that the utility ditches be visually inspected during the excavation process to help ensure that undesirable fill that was not detected by the test borings does not exist at the site. This office should be notified immediately if any such fill is detected.

7. Granular materials including bedding sand, pipe bedding, gravel, or any material containing less than 5 percent clay should not be used for any purpose without further consultation with the geotechnical engineer.

PAVEMENTS

General

Specific wheel loading and traffic volume characteristics have not been provided, but we assume that passenger vehicles traffic will be predominant in the parking areas, and infrequent heavy truck and bus traffic may occur in drive areas around the structures and in the fire lanes. We have assumed that Portland Cement concrete pavement sections will be used for light and heavy traffic areas. Recommended asphaltic concrete pavement sections can be provided on request.

For heavy traffic areas, we have assumed 20 equivalent 18-kip axle loadings per day for a design period of 15 years. For light traffic areas, we have assumed 2 equivalent 18-kip axle loadings per day for a design period of 15 years.

Concrete Pavements

The following Portland cement concrete pavement sections are recommended for this site:

Traffic / Layer Material	Thickness (inches)
Light Traffic:	
Portland Cement Concrete	5.0
Lime Stabilized Subgrade	6.0
Heavy Traffic	
Portland Cement Concrete	6.0
Lime Stabilized Subgrade	6.0

The subgrade soils should be cleared and grubbed prior to lime stabilization. On-site soils can be used as fill to raise site grade for the pavement areas. The fill should be placed in accordance with the criteria contained above. Six (6) percent hydrated lime by dry soil weight (27 pounds per square yard for a 6-inch thick stabilized layer) is estimated based on our

experience in the area. Lime stabilization should be in accordance with Item 260 of the TxDOT Standard Specifications for Construction of Highways, Streets and Bridges (1982).

Some differential movement in the pavements are anticipated due to swelling of the subgrade clays. Pavement recommendations are based on assumed loading conditions and commonly accepted design procedures that should provide satisfactory performance with relatively low maintenance for the design life of 15 years for the assumed traffic loadings. Thinner pavement sections could be used if greater maintenance costs and shorter pavement life is acceptable, or if our assumed loading conditions are too severe. Additional evaluation of the pavement design can be performed upon request on the basis of more specific estimates of the design traffic and design period.

Design of the concrete pavements should specify a minimum 28-day concrete compressive strength of 3,600 psi with 4 percent to 6 percent entrained air. Hand-placed concrete should have a maximum slump of 4 inches. A sand leveling course should not be permitted beneath pavements. The concrete should be placed within one and one-half hours of batching. During hot weather, the concrete placement should follow ACI 311 Hot Weather concreting guidelines. In no case should concrete temperature exceed 95°F. Consideration should be given to limiting concrete placement to the time of day, which will minimize large differences in the ambient and concrete temperature. Use of superplasticizer should be considered to improve the concrete workability without increasing water cement ratio.

Past experience indicates that pavements with sealed joints on 15 to 20-foot spacings, cut to a depth of at least one-quarter of the pavement thickness, have generally exhibited less uncontrolled, post-construction cracking than pavements with wider joint spacings. As a minimum, expansion joints should be used wherever the pavement will abut a structural element subject to different movement levels, e.g., light poles, retaining walls, existing pavement, stairways, entryway piers, building walls, or manholes. After construction, the construction and expansion joints should be inspected periodically and resealed, as necessary. The pavement should be nominally reinforced using at least No. 3 bars, 24 inches on center, each way.

SITE GRADING, DRAINAGE, AND LANDSCAPING

In our experience, expansive clay cut and fill slopes should be gentle and preferably should not exceed about 5 horizontal to 1 vertical (5H:1V). Special consideration should be given to any steeper slopes that exceed 10 feet in height. This office should review such slope conditions.

Excess water ponding on and beside roadways, sidewalks, and structural slabs can cause unacceptable heave of these structures. To reduce this potential heave, good surface drainage should be established in all building and pavement areas. Sprinkler systems should be designed and operated to minimize saturation of soil adjacent to these structures. Sprinkler mains should not be placed next to buildings.

Trees will remove water from the soil and, as a result, can cause the soil to shrink; therefore, where pavements are planned, trees should either a) not be planted closer than the mature tree height from the building, b) have a controlled irrigation system, or c) be planted in containers.

Bedding soils for plants may collect and direct water underneath the buildings and pavements; therefore, care should be taken to insure that water entering the bedding soils drains away from these structures. If positive drainage away from these structures cannot be achieved, an impermeable synthetic membrane should be considered to reduce the risk of water migrating beneath the buildings and pavements. An 18-inch deep vertical water barrier along the pavement edge fronting landscaped areas may be desirable to help prevent irrigation water from having ready access to the soils beneath the pavement. Special attention should be given to provide good drainage from plantings inside the building courtyards and planter boxes.

The completed landscaping should be carefully inspected to verify that plantings properly drain. Soil in plantings may settle, which will tend to pond water, or plantings may block entrances to surface drains. Therefore, maintaining positive drainage from landscape irrigation will be an ongoing concern.

LIMITATIONS

Since some variation was found in subsurface conditions at boring locations, all parties involved should take notice that even more variation may be encountered between boring locations. Statements in the report as to subsurface variation over given areas are intended only as estimations from the data obtained at specific boring locations.

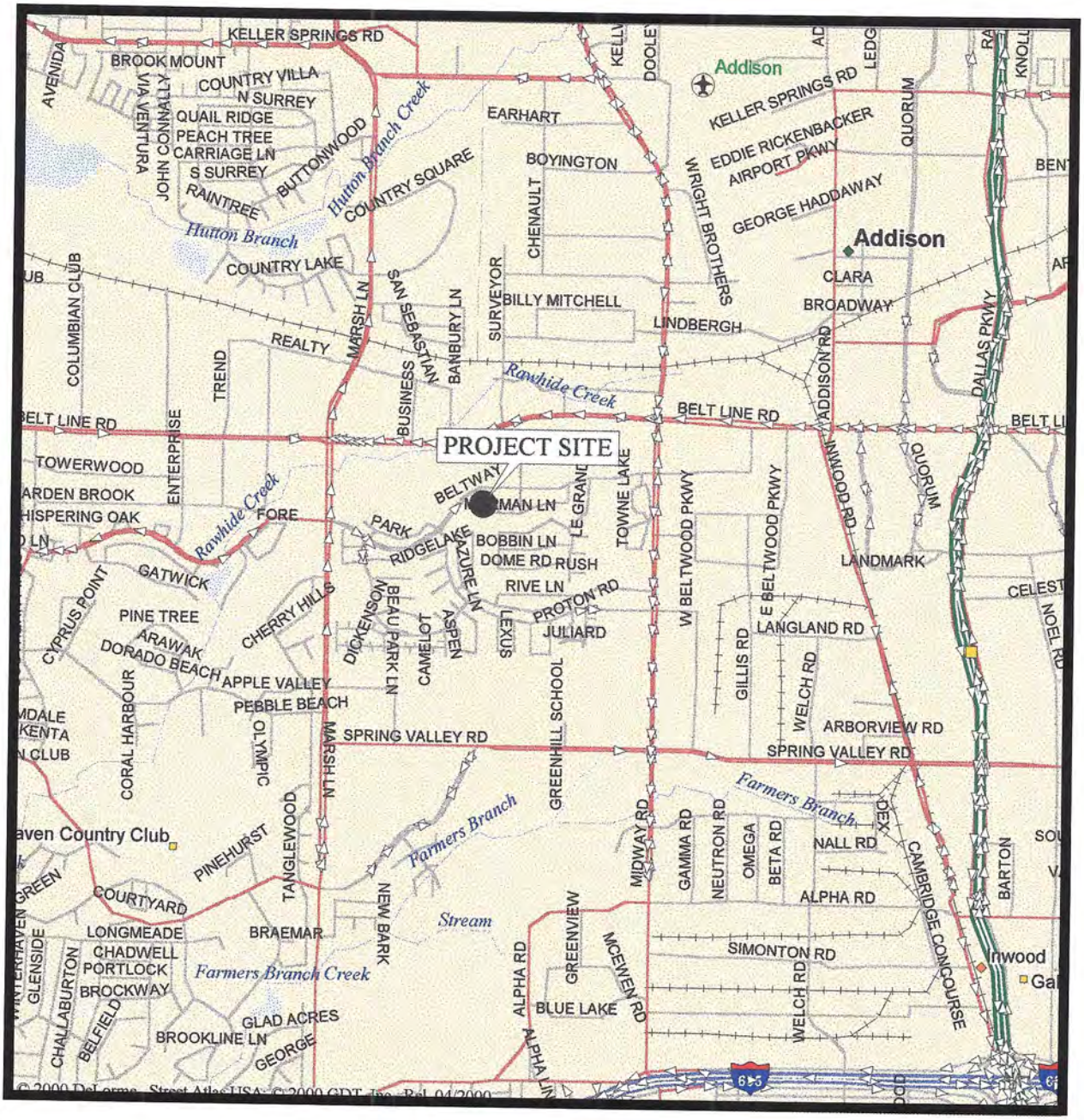
The professional services that form the basis for this report have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No other warranty, expressed or implied, is made as to the professional advice set forth.

The results, conclusions, and recommendations contained in this report are directed at, and intended to be utilized within, the scope of work contained in the proposal letter executed by Fugro South, Inc. and client. This report is not intended to be used for any other purposes. Fugro South, Inc. makes no claim or representation concerning any activity or condition falling outside the specified purposes to which this report is directed, said purposes being specifically limited to the scope of work as defined in said agreement. Inquiries as to said scope of work or concerning any activity or condition not specifically contained therein should be directed to Fugro South for a determination and, if necessary, further investigation.

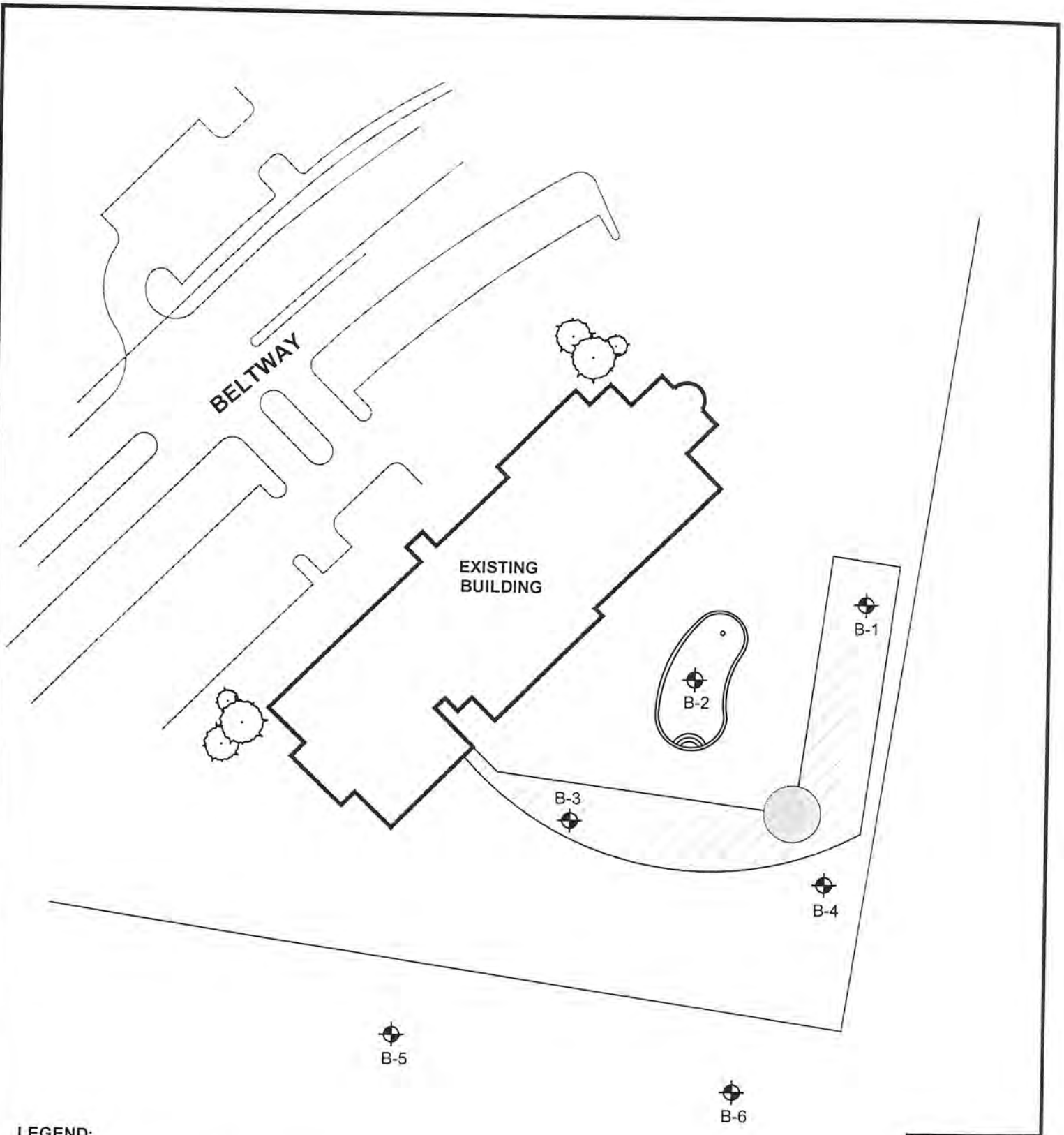
ILLUSTRATIONS

Boring and laboratory data presented were developed solely for the preparation of this report. We are not responsible for interpretation or use of these data for purposes beyond the stated scope of this report.

Subsurface conditions different than those found at our boring location may be present as a result of, among other factors, soil moisture variations, fill placement, and naturally occurring variations in soil properties and elevation of the top of the rock.



FUGRO SOUTH, INC. *Geotechnical Engineering and Materials Testing*	**ADDISON ATHLETIC CLUB**				**Site Vicinity Map**
	3900 Beltway				**Addison, Texas**
	Date: 20 April 01	Scale: Not to Scale	Map Source: DeLorme Street Atlas	Project No. 0701-1049	**PLATE A**



LEGEND:

⊕ APPROXIMATE BORING LOCATION

NOT TO SCALE

North

FUGRO SOUTH, INC.	**ADDISON ATHLETIC CLUB**			**Plan Of Borings**
	3900 Beltway			**Addison, Texas**
	Date: 4/20/01	Drawn By: WR	Project No.: 0701-1049	**PLATE B**

LOG OF BORING NO. B- 1

ADDISON ATHLETIC CLUB
3900 Beltway
Addison, Texas
PROJECT NO. 0701-1049

TYPE: INTERMITTENT SAMPLING

LOCATION: SEE PLAN OF BORINGS

SURF. ELEVATION: UNKNOWN

DEPTH, FT	SAMPLES	POCKET PEN N PER FOOT REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	UNCONFINED STRENGTH TSF
		P 4.0	**CLAY (CH)**, Brown, silty, some limestone fragments		23	44	23	21			
		40									
		50/3"			13						
			LIMESTONE, Tan, weathered	4.0							
5		50/4"			15						
		100/3"			15						
10		100/1.25"									
15		100/1.5"									
			LIMESTONE, Gray, fresh	17.0							
20		100/1.25"			14						
25		100/0.75"		25.0	16						

COMPLETION DEPTH: 25.0
DATE DRILLED: 3-31-01

WATER LEVEL / SEEPAGE: DRY
UPON COMPLETION: DRY

KEY:
P = Pocket Penetrometer
Note: All depths are measured in feet.

GEO3 01-1049.GPJ GEO1.GDT 4/20/01

FUGRO SOUTH, INC.

PLATE 1

LOG OF BORING NO. B- 2

ADDISON ATHLETIC CLUB
3900 Beltway
Addison, Texas
PROJECT NO. 0701-1049

TYPE: INTERMITTENT SAMPLING

LOCATION: SEE PLAN OF BORINGS

SURF. ELEVATION: UNKNOWN

DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN N PER FOOT REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	UNCONFINED STRENGTH TSF
			P 4.0	**CLAY (CH)**, Brown, silty, some limestone fragments		28	45	23	22			
			11			15						
						15						
			54									
5			44			15						
				LIMESTONE, Tan, weathered	6.0							
			50/3"									
				- highly weathered to 8'								
				- moderatly weathered below 8'								
10			50/2"			16						
				LIMESTONE, Gray, fresh	14.0							
15			100/0.5"			12						
20			100/0.75"			14						
			100/0.75"									
25					25.0							

COMPLETION DEPTH: 25.0
DATE DRILLED: 3-31-01

WATER LEVEL / SEEPAGE: 7.0
UPON COMPLETION: DRY

KEY:
P = Pocket Penetrometer
Note: All depths are measured in feet.

GEO3 01-1049.GPJ GEO1.GDT 4/20/01

FUGRO SOUTH, INC.

PLATE 2

LOG OF BORING NO. B- 3

ADDISON ATHLETIC CLUB
3900 Beltway
Addison, Texas
PROJECT NO. 0701-1049

TYPE: INTERMITTENT SAMPLING

LOCATION: SEE PLAN OF BORINGS

DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN N PER FOOT REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	UNCONFINED STRENGTH TSF
				SURF. ELEVATION: UNKNOWN								
			P 4.0	**FILL**, Clay (CH), Brown, silty, some limestone fragments		28						
			P 3.5			27	56	25	31			
			16			26						
			P 4.0	**CLAY (CH)**, Brown, silty, some limestone fragments	4.0	39	74	39	35			
5			50/6"			11						
				LIMESTONE, Tan, weathered	6.0							
				LIMESTONE, Gray, fresh	9.0							
10			100/1"			11						
15			100/0.5"			14						
20			100/0.5"			12						
					20.0							

COMPLETION DEPTH: 20.0
DATE DRILLED: 3-31-01

WATER LEVEL / SEEPAGE: DRY
UPON COMPLETION: DRY

KEY:
P = Pocket Penetrometer
Note: All depths are measured in feet.

GEO3 01-1049.GPJ GEO1.GDT 4/20/01

FUGRO SOUTH, INC.

PLATE 3

LOG OF BORING NO. B- 4

ADDISON ATHLETIC CLUB
3900 Beltway
Addison, Texas
PROJECT NO. 0701-1049

TYPE: INTERMITTENT SAMPLING

LOCATION: SEE PLAN OF BORINGS

DEPTH, FT	SAMPLES	POCKET PEN N PER FOOT REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	UNCONFINED STRENGTH TSF
			SURF. ELEVATION: UNKNOWN								
		P 4.0	- Concrete 6"		26						
			CLAY (CH), Brown, silty, some limestone fragments	0.5							
		P 4.5			28				75		
		50/5"			22						
			LIMESTONE, Tan, weathered	2.5							
5		50/3"									
			LIMESTONE, Gray, fresh	6.5							
		100/1.5"									
10		100/1"			13						
15		100/0.5"			15						
				16.0							
20											

COMPLETION DEPTH: 16.0
DATE DRILLED: 3-31-01

WATER LEVEL / SEEPAGE: DRY
UPON COMPLETION: DRY

KEY:
P = Pocket Penetrometer
Note: All depths are measured in feet.

GEO3 01-1049.GPJ GEO1.GDT 4/20/01

FUGRO SOUTH, INC.

PLATE 4

LOG OF BORING NO. B- 5

ADDISON ATHLETIC CLUB
3900 Beltway
Addison, Texas
PROJECT NO. 0701-1049

TYPE: INTERMITTENT SAMPLING

LOCATION: SEE PLAN OF BORINGS

DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN N PER FOOT REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	UNCONFINED STRENGTH TSF
				SURF. ELEVATION: UNKNOWN								
			50/3"	**CLAY (CH)**, Brown, silty, some limestone fragments		22						
						14						
				LIMESTONE, Tan, weathered	1.5							
			50/3"									
			100/2"			14						
5					5.0							
10												
15												
20												

COMPLETION DEPTH: 5.0
DATE DRILLED: 3-31-01

WATER LEVEL / SEEPAGE: DRY
UPON COMPLETION: DRY

KEY:
P = Pocket Penetrometer
Note: All depths are measured in feet.

GEO3 01-1049.GPJ GEO1.GDT 4/20/01

FUGRO SOUTH, INC.

PLATE 5

LOG OF BORING NO. B- 6

ADDISON ATHLETIC CLUB
3900 Beltway
Addison, Texas
PROJECT NO. 0701-1049

TYPE: INTERMITTENT SAMPLING

LOCATION: SEE PLAN OF BORINGS

DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN N PER FOOT REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	UNCONFINED STRENGTH TSF
				SURF. ELEVATION: UNKNOWN								
			75	**CLAY (CH)**, Brown, silty, some limestone fragments		33						
				LIMESTONE, Tan, weathered	1.0							
			50/5"			17						
			100/3"									
5					5.0							
10												
15												
20												

COMPLETION DEPTH: 5.0
DATE DRILLED: 3-31-01

WATER LEVEL / SEEPAGE: DRY
UPON COMPLETION: DRY

KEY:
P = Pocket Penetrometer
Note: All depths are measured in feet.

GEO3 01-1049.GPJ GEO1.GDT 4/20/01

FUGRO SOUTH, INC.

PLATE 6

TERMS AND SYMBOLS USED ON BORING LOGS FOR SOIL

SOIL TYPES


CLAY (CH)


SHALY CLAY (CH)


CLAY (CL)


SANDY CLAY (CL)


Well-Graded **SAND (SW)**


Poorly-Graded **SAND (SP)**


SILTY SAND (SM)


CLAYEY SAND (SC)

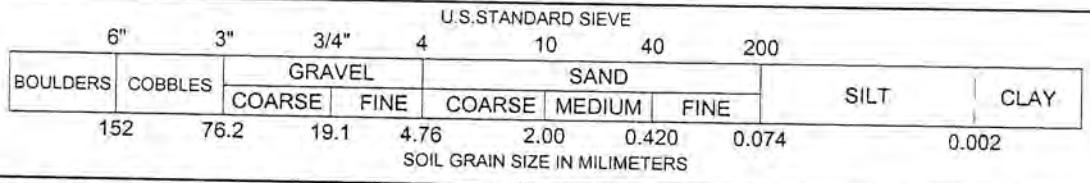

Well-Graded **GRAVEL (GW)**


Poorly-Graded **GRAVEL (GP)**


SILTY GRAVEL (GM)


FILL Material

SOIL GRAIN SIZE



STRENGTH OF COHESIVE SOILS [2]

CONSISTENCY	UNDRAINED COMPRESSIVE STRENGTH Tons Per Sq. Ft.
Very Soft	Less Than 0.25
Soft	0.25 to 0.50
Firm	0.5 to 1.00
Stiff	1.00 to 2.00
Very Stiff	2.00 to 4.00
Hard	greater than 4.00

DENSITY OF GRANULAR SOILS [2]

NUMBER OF BLOWS PER FT., N	RELATIVE DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium
30-50	Dense
Over 50	Very Dense

DESCRIPTIVE TERMS FOR SOIL [1]

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 6 mm thick.
Laminated	Alternating layers of varying material or color with the layers less than 6 mm thick.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusions of small pockets of different soils.

MOISTURE

Dry	No water evident in sample; fines less than plastic limit.
Moist	Sample feels damp; fines near the plastic limit
Very Moist	Water visible on sample; fines greater plastic limit and less than liquid limit
Wet	Sample bears free water; fines greater than liquid limit.

INCLUSIONS [1]

Parting	Inclusion <1/8" thick extending through sample
Seam	Inclusion 1/8" to 3" thick extending through sample.
Layer	Inclusion >3" thick extending through sample.
Trace	<5% of sample.
Few	5% to 10% of sample.
Some	10 to 25% of sample.
With	30% to 45% of sample.

REFERENCES:

1) ASTM D 2488

2) Peck, Hanson and Thornburn, (1974), Foundation Engineering.

NOTE:

Information on each boring log is a compilation of subsurface conditions and soil and rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated, and may vary with time, geologic condition or construction activity.

TERMS AND SYMBOLS USED ON BORING LOGS FOR ROCK

ROCK TYPES


LIMESTONE


SHALE


SANDSTONE


WEATHERED LIMESTONE


WEATHERED SHALE


WEATHERED SANDSTONE


HIGHLY WEATHERED LIMESTONE


ARGILLACEOUS LIMESTONE


MARL

SAMPLER TYPES


Thin-walled Tube


Rock Core


Standard Penetration Test


Auger Sample


THD Cone Penetration Test


Bag Sample

SOLUTION & VOID CONDITIONS

Void	Interstice; a general term for pore space or other openings in rock.
Cavities	Small solutional concavities.
Vuggy	Containing small cavities, usually lined with a mineral of different composition from that of the surrounding rock.
Vesicular	Containing numerous small, unlined cavities, formed by expansion of gas bubbles or steam during solidification of the rock.
Porous	Containing pore, interstices, or other openings which may or may not interconnect.
Cavernous	Containing cavities or caverns, sometimes quite large. Most frequent in limestones and dolomites.

WEATHERING GRADES OF ROCKMASS (1)

Slightly	Discoloration indicates weathering of rock material and discontinuity surfaces.
Moderately	Less than half of the rock material is decomposed or disintegrated to a soil.
Highly	More than half of the rock material is decomposed or disintegrated to a soil.
Completely	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed.

HARDNESS

Friable	Crumbles under hand pressure
Low Hardness	Can be carved with a knife
Moderately Hard	Can be scratched easily with a knife
Very Hard	Cannot be scratched with a knife

BEDDING THICKNESS (2)

Very Thick	>4'
Thick	2'-4'
Thin	2"-2'
Very Thin	1/2"-2"
Laminated	0.08"-1/2"
Thinly-Laminated	<0.08"

JOINT DESCRIPTION

SPACING		INCLINATION		SURFACES	
Very Close	<2"	Horizontal	0-5	Slickensided	Polished, grooved
Close	2"-12"	Shallow	5-35	Smooth	Planar
Medium Close	12"-3'	Moderate	35-65	Irregular	Undulating or granular
Wide	>3'	Steep	65-85	Rough	Jagged or pitted
		Vertical	85-90		

REFERENCES:

1) British Standard(1981) Code of Practice for Site Investigation BS 5930.

2) The Bridge Division, Texas Highway Dept. Foundation Exploration & Design Manual 2nd Edition,revised June,1974.

NOTE:

Information on each boring log is a compilation of subsurface conditions and soil and rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated, and may vary with time, geologic condition or construction activity.

Geotechnical Investigation
Addison Athletic Club Expansion 2000
Addison, Texas

SUMMARY OF FREE SWELL TESTS	
Boring Number	B-2
Sample Depth (ft.)	5-6
Initial Moisture Content (%)	22
Final Moisture Content (%)	25
Applied Surcharge Pressure (psf)	1250
Vertical Swell (%)	0.0
Liquid Limit	43
Plastic Limit	19
Plasticity Index	24

APPENDIX

LIME STABILIZATION RECOMMENDATIONS FOR PAVEMENT SUBGRADE SOILS

Addison Athletic Club Expansion 2000
Addison, Texas

Application

The hydrated lime should be applied only in the area where the first mixing operations can be completed during the same working day.

The hydrated lime should be placed by the slurry method. The hydrated lime should be mixed with water in trucks or in tanks and applied as a thin water suspension or slurry. The distributor truck or tank should be equipped with an agitator, which will keep the lime and water in a uniform mixture. Approximately 27 pounds of hydrated lime per square yard will give the 6 percent required for a 6-inch thick stabilized subgrade. By calculating the number of square yards in each area and by knowing the amounts per truckload, the rate of application can be checked very closely.

Mixing

The material and hydrated lime should be thoroughly mixed by a rotary mixer or other device to obtain a homogeneous, friable mixture of material and lime free from all clods or lumps and left to cure from one to four days. From our experience, we have found that a curing period of 48 to 72 hours is adequate. During the curing period, the material should be kept moist.

Final Mixing

After the required curing time, the material should be uniformly mixed with a rotary mixer capable of reducing the size of the particles so that when all non-slaking aggregates (asphalt particles) retained on the No. 4 sieve are removed, the remainder of the material shall meet the following requirements when tested dry by laboratory sieves:

Minimum passing 1-3/4" sieve – 100%

Minimum passing No. 4 sieve – 60%

During the interval of time between applications and mixing, the hydrated lime should not be exposed to the open air for a period of over six hours.

Compaction

Compaction of the mixture should begin immediately after final mixing, and in no case later than three calendar days after final mixing. The material should be aerated or sprinkled as necessary to provide the optimum moisture. Compaction should begin at the bottom and continue until the entire depth of mixture is uniformly compacted. All

irregularities, depressions, or weak spots that develop must be corrected immediately by scarifying the areas affected, adding or removing material, and reshaping and recompacting by sprinkling and rolling. The surface should be maintained in a smooth condition – free from undulations and ruts.

The subgrade should be compacted to a minimum of 95 percent of Standard Proctor density (ASTM D 698), at a moisture content within 3 percentage points of optimum moisture content. Compaction and moisture checks should be taken within all paving areas at the rate of one field density test per lift, per each 5,000 square feet. These tests are necessary to determine if the recommended moisture and compaction requirements have been attained. After the required compaction is reached, the subgrade should be brought to the required lines and grades and finished by rolling with a pneumatic tire or other suitable roller sufficiently light to prevent hair cracking.

SECTION 01 1000

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Owner-furnished products.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.

1.2 PROJECT INFORMATION

A. Project Identification: Addison Athletic Club Renovations.
1. Project Location: 3900 Beltway Drive; Addison, Texas 75001.

B. Owner: City of Addison; 5300 Belt Line Road; Dallas, Texas 75254.

C. Architect: LPA Design Studios; 1801 North Lamar, Suite 150; Dallas, Texas 75202.

D. Architect's Consultants: Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Refer to Title Page.

E. Web-Based Project Software: Project software administered by Architect will be used for purposes of managing communication and documents during the construction stage.
1. See Section 01 3100 "Project Management and Coordination." for requirements for using web-based Project software.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Interior renovations and remodeling and exterior site work of existing athletic club and other Work indicated in the Contract Documents.

B. Type of Contract:
1. Project will be constructed under a single prime contract.

1.4 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.5 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.
1. Owner-Furnished Owner-Installed Products:
a. As scheduled.

B. Owner will furnish products indicated for Contractor to install. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
1. Owner-Furnished Contractor-Installed Products:
a. As scheduled.

1.6 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
   2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated.
   1. Weekend Hours: Coordinate with Owner.
   2. Early Morning Hours: Coordinate with Owner and in accordance with local code.
   3. Hours for Utility Shutdowns: Coordinate with Owner.
   4. Hours for Noisy Activities: Coordinate with Owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than two days in advance of proposed disruptive operations.
   2. Obtain Owner's written permission before proceeding with disruptive operations.

A. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

E. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the 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 the Specifications. The words "shall," "shall be," or "shall comply with," depending on the 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 all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the 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 published as part of the U.S. National CAD Standard and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 2200

UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

1.2 DEFINITIONS

A. Unit price is an amount incorporated into 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.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

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.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1 – Moisture Vapor Emission Control System: Refer to Section 09 0561.13 "Moisture Vapor Emission Control System."
   1. Provide cost per square foot for complete system, including shot-blasting concrete substrate, application of penetrant, post-application moisture and alkalinity testing, application of cementitious underlayment, and manufacturer’s 15-year warranty.

B. Unit Price No. 2 – Drilled Piers:
   1. For actual depth versus anticipated depth indicated on Drawings.
   2. Cost of providing and placing casings is not included Base Contract.
   3. Reconciliation: Per pier diameter category for net add or deduct, not per individual pier.
   4. Diameter Categories: Refer to Structural Drawings.
   5. For each diameter category pier required, provide:
      a. Unit price per additional lineal foot of completed pier.
      b. Unit price per deleted lineal foot of completed pier. Unit price shall be no less than 75 percent of unit price for additional lineal foot.

C. Unit Price No. 3 – Addition of Casing: Base Bid price shall not include casing of drilled concrete piers. Provide Unit Price for addition of steel casing to a depth of 20 feet below grade in the event casing of piers is required by encountered subsurface conditions:
   1. Include cost of providing uncased drilled piers in Base Contract.
   2. Reconciliation: Per pier diameter category for net add per individual pier.
   3. Diameter Categories: Refer to Structural Drawings.

END OF SECTION

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SECTION 01 2300

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 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 the 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 alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: 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. Execute accepted alternates under the same conditions as other work of the Contract.

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Community Room (142) Cabinetry.
   1. Base Bid: Existing cabinetry to remain in place.
   2. Alternate: Remove and replace existing 26’-0” linear feet of upper and lower cabinets with new thermofoil raised panel casework in shaker style. Color: TBD. Provide new solid surface countertop and (2) replacement stainless steel sinks with faucets.

B. Alternate No. 2: Acoustical Panel Ceilings
   1. Base Bid: Carefully remove and reinstall 25% of existing ACT, grid, and lighting for mechanical scope, re: mechanical.
   2. Alternate: Provide new ACT and grid at all 2x2 ACT locations with mechanical scope above ceiling and reinstall existing lighting U.O.N.

END OF SECTION

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SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit PDF file(s) electronically for 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: Use facsimile of form provided in Project Manual.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions 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.
         1) Submit physical samples for color and finish selections.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
      j. Detailed comparison of Contractor's construction schedule using proposed substitutions 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.
      k. Cost information, including a proposal of change, if any, in the Contract Sum.
      l. Contractor'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.
      m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
   3. Any substitution request made that is not on required form, is not completely filled in, or does not provide required backup documentation will be rejected without review.

4. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within sevendays of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or days of receipt of additional information or documentation, whichever is later.
    a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
    b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. 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.

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 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.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 2500.13

SUBSTITUTION REQUEST FORM

PROJECT: _____ **(After Contract Award)**

TO: _____ _____

NO._____ DATE: _____

Contractor hereby requests acceptance of the following product or system as a substitution in accordance with provisions of Division 01 Section "Substitution Procedures:"

1. SPECIFIED PRODUCT OR SYSTEM

Substitution request for: _____

Specification Section No.: _____ Article/ Paragraph: _____

2. REASON FOR SUBSTITUTION REQUEST

SPECIFIED PRODUCT . . .

- ☐ Is no longer available.
- ☐ Is unable to meet project schedule.
- ☐ Is unsuitable for the designated application.
- ☐ Cannot interface with adjacent materials.
- ☐ Is not compatible with adjacent materials.
- ☐ Cannot provide the specified warranty.
- ☐ Cannot be constructed as indicated
- ☐ Cannot be obtained due to one or more of the following:
  - ☐ Strike
  - ☐ Lockout
  - ☐ Bankruptcy of manufacturer or supplier
  - ☐ Similar occurrence (explain below)

PROPOSED PRODUCT . . .

- ☐ Will reduce construction time
- ☐ Will result in cost savings of $ _____ to Project
- ☐ Is for supplier's convenience
- ☐ Is for subcontractor's convenience
- ☐ Other: _____ _____

3. SUPPORTING DATA

- ☐ Drawings, specifications, product data, performance data, test data, and any other necessary information to facilitate review of the Substitution Request are attached.
- ☐ Sample is attached.
- ☐ Sample will be sent if requested.

4. QUALITY COMPARISON: Provide all necessary side-by-side comparative data as required to facilitate review of Substitution Request:

	SPECIFIED PRODUCT	PROPOSED PRODUCT
Manufacturer:	_____	_____
Name / Brand:	_____	_____
Catalog No.:	_____	_____
Vendor:	_____	_____
Variations:	_____	_____

(Add Additional Sheets If Necessary)

Local Distributor or Supplier: _____

Maintenance Service Available: ☐ Yes ☐ No

Spare Parts Source: _____

Warranty: ☐ Yes ☐ No _____ Years

5. PREVIOUS INSTALLATIONS

Identification of at least three similar projects on which proposed substitution was used:

PROJECT #1:_____

Address:_____

Architect:_____

Owner:_____

Contractor:_____

Date Installed: _____

PROJECT #2: _____

Address:_____

Architect:_____

Owner:_____

Contractor:_____

Date Installed: _____

PROJECT #3: _____

Address: _____

Architect: _____

Owner: _____

Contractor: _____

Date Installed: _____

6. EFFECT OF SUBSTITUTION

Proposed substitution affects other work or trades: ☐ No ☐ Yes (if Yes, explain)

_____

_____

Proposed substitution requires dimensional revisions or redesign of architectural, structural, M-E-P, life safety, or other work:

☐ No ☐ Yes (if Yes, attach data explaining revisions)

7. STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS

Contractor and Subcontractor have investigated the proposed substitution and hereby represent that:

A. They have personally investigated the proposed substitution and believe that it is equal to or superior in all respects to specified product, except as stated above;
B. The proposed substitution is in compliance with applicable codes and ordinances;
C. The proposed substitution will provide same warranty as specified for specified product;
D. They will coordinate the incorporation of the proposed substitution into the Work, and will include modifications to the Work as required to fully integrate the substitution;
E. They have included complete cost data and implications of the substitution (attached);
F. They will pay any redesign fees incurred by the Architect or any of the Architect's consultants, and any special inspection costs incurred by the Owner, caused by the use of this product;
G. They waive all future claims for added cost or time to the Contract related to the substitution, or that become known after substitution is accepted.
H. The Architect's approval, if granted, will be based upon reliance upon data submitted and the opinion, knowledge, information, and belief of the Architect at the time decision is rendered and Addendum is issued; and that Architect's approval therefore is interim in nature and subject to reevaluation and reconsideration as additional data, materials, workmanship, and coordination with other work are observed and reviewed.

Contractor: _____

(Name of Contractor)

Date: _____ By: _____

Subcontractor: _____

(Name of Subcontractor)

Date: _____ By: _____

Note: Unresponsive or incomplete requests will be rejected and returned without review.

8. ARCHITECT'S REVIEW AND ACTION

- ☐ Substitution is accepted.
- ☐ Substitution is accepted, with the following comments: _____

  _____
- ☐ Resubmit Substitution Request:
  - ☐ Provide more information in the following areas: _____

    _____
    - ☐ Provide proposal indicating amount of savings / credit to Owner
    - ☐ Bidding Contractor shall sign Bidder's Statement of Conformance
    - ☐ Bidding Subcontractor shall sign Bidder's Statement of Conformance
- ☐ Substitution is not accepted:
  - ☐ Substitution Request received too late.
  - ☐ Substitution Request received directly from subcontractor or supplier.
  - ☐ Substitution Request not submitted in accordance with requirements.
  - ☐ Substitution Request Form is not properly executed.
  - ☐ Substitution Request does not indicate what item is being proposed.
  - ☐ Insufficient information submitted to facilitate proper evaluation.
  - ☐ Proposed product does not appear to comply with specified requirements.
  - ☐ Proposed product will require substantial revisions to Contract Documents.

By: _____ Date: _____

Architect has relied upon the information provided by the Contractor, and makes no claim as to the accuracy, completeness, or validity of such information. If an accepted substitution is later found to be not in compliance with the Contract Documents, Contractor shall provide the specified product.

9. OWNER'S REVIEW AND ACTION

- ☐ Substitution is accepted; Architect to prepare Change Order.
- ☐ Substitution is not accepted.
- ☐ Owner will pay Architect directly for redesign fees.
- ☐ Include Architect's Additional Service fee for implementing the substitution in the Change Order.

By: _____ Date:_____
(Owner/Owner's Representative)

END OF FORM

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SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 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.
   1. Within time specified in Proposal Request or 10 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.
   2. Within time specified in Proposal Request or 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.
      a. 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.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. 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.
      e. Quotation Form: Use forms acceptable to Architect.

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. Within 7 days after submittal of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
   2. 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.
   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. Comply with requirements in Section 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
   8. Proposal Request Form: Use form acceptable to Architect.

A. Do not proceed with changes until receipt of written approval by Architect and Owner.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Section 01 2200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Contractor will issue a Change Order for signatures of Owner and Architect on AIA Document G701.

1.6 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: 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.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's Project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange schedule of values consistent with format of AIA Document G703.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
   4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site.
   5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
   6. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
   7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 APPLICATIONS FOR PAYMENT

A. 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.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
   1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. 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.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, 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.

F. Transmittal: Submit three signed and notarized original copies of each 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.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   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. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. 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.
   5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. 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. Schedule of unit prices.
   6. Submittal schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.
   14. Data needed to acquire Owner's insurance.

I. 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.

J. 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.
   4. AIA Document G706.
   5. AIA Document G706A.
   6. Evidence that claims have been settled.
   7. Final meter readings for utilities, a measured record of stored fuel, 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. RFIs.
   4. Digital project management procedures.
   5. Project meetings.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 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, telephone number, and email address 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 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 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 project meeting room, in temporary field office, in web-based Project software directory, and in prominent location inbuilt facility. Keep list current at all times.

1.4 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 Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.

5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      e. Indicate required installation sequences.
      f. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
   2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
   3. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
      a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
   4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
      a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
      b. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Architect.
   6. RFI number, numbered sequentially.

7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 2600 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
    a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

4. The following digital data files will be furnished for each appropriate discipline:
   a. Floor plans.
   b. Reflected ceiling plans.

B. Web-Based Project Software: Use Architect's web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 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 a minimum of 10 working days prior to meeting.
2. Agenda: Prepare meeting agenda. Distribute agenda to 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 days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Responsibilities and personnel assignments.
   b. Tentative construction schedule.
   c. Critical work sequencing and long lead items.
   d. Designation of key personnel and their duties.
   e. Lines of communications.
   f. Use of web-based Project software.
   g. Procedures for processing field decisions and Change Orders.
   h. Procedures for RFIs.
   i. Procedures for testing and inspecting.
   j. Procedures for processing Applications for Payment.
   k. Distribution of the Contract Documents.
   l. Submittal procedures.
   m. Preparation of Record Documents.
   n. Use of the premises.
   o. Work restrictions.
   p. Working hours.
   q. Owner's occupancy requirements.
   r. Responsibility for temporary facilities and controls.
   s. Procedures for moisture and mold control.
   t. Procedures for disruptions and shutdowns.
   u. Construction waste management and recycling.
   v. Parking availability.
   w. Office, work, and storage areas.
   x. Equipment deliveries and priorities.
   y. First aid.
   z. Security.
   aa. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related RFIs.
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Review of mockups.
      i. Possible conflicts.
      j. Compatibility requirements.
      k. Time schedules.
      l. Weather limitations.
      m. Manufacturer's written instructions.
      n. Warranty requirements.
      o. Compatibility of materials.
      p. Acceptability of substrates.
      q. Temporary facilities and controls.
      r. Space and access limitations.
      s. Regulations of authorities having jurisdiction.
      t. Testing and inspecting requirements.
      u. Installation procedures.
      v. Coordination with other work.
      w. Required performance results.
      x. Protection of adjacent work.
      y. Protection of construction and personnel.
   3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
   4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
   5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
      a. Preparation of Record Documents.
      b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
      c. Procedures for completing and archiving web-based Project software site data files.
      d. Submittal of written warranties.
      e. Requirements for completing sustainable design documentation.
      f. Requirements for preparing operations and maintenance data.
      g. Requirements for delivery of material samples, attic stock, and spare parts.
      h. Requirements for demonstration and training.
      i. Preparation of Contractor's punch list.

j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
k. Submittal procedures.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner 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. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
1) Review schedule for next period.
b. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site use.
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.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Daily construction reports.
   3. Material location reports.
   4. Site condition reports.
   5. Unusual event reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
   1. Critical 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.

B. 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.

C. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

D. Daily Construction Reports: Submit at weekly intervals.

E. Material Location Reports: Submit at monthly intervals.

F. Site Condition Reports: Submit at time of discovery of differing conditions.

G. Unusual Event Reports: Submit at time of unusual event.

H. Qualification Data: For scheduling consultant.

1.4 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
   1. Review software limitations and content and format for reports.
   2. Verify availability of qualified personnel needed to develop and update schedule.
   3. Discuss constraints, including work stages and interim milestones.

4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.5 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 3300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
   4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
   5. Commissioning Time: Include no fewer than 15 days for commissioning.
   6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
   7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
   2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   3. Work Restrictions: Show the effect of the following items on the schedule:
      a. Seasonal variations.
      b. Environmental control.
   4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
      a. Subcontract awards.
      b. Submittals.
      c. Purchases.
      d. Mockups.
      e. Fabrication.
      f. Sample testing.
      g. Deliveries.
      h. Installation.

i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.
m. Commissioning.

5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
   a. Structural completion.
   b. Temporary enclosure and space conditioning.
   c. Permanent space enclosure.
   d. Completion of mechanical installation.
   e. Completion of electrical installation.
   f. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
   1. Temporary enclosure and space conditioning.
   2. .

F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
   1. See Section 01 2900 "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered Requests for Information.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and the Contract Time.

H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate final completion percentage for each activity.

I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

J. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work.
   1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
   1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.8 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Equipment at Project site.
   5. Material deliveries.
   6. High and low temperatures and general weather conditions, including presence of rain or snow.
   7. Testing and inspection.
   8. Accidents.
   9. Meetings and significant decisions.
   10. Unusual events.
   11. Stoppages, delays, shortages, and losses.
   12. Meter readings and similar recordings.
   13. Emergency procedures.
   14. Orders and requests of authorities having jurisdiction.
   15. Change Orders received and implemented.
   16. Construction Change Directives received and implemented.
   17. Services connected and disconnected.
   18. Equipment or system tests and startups.
   19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
   1. Material stored prior to previous report and remaining in storage.
   2. Material stored prior to previous report and since removed from storage and installed.
   3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
   1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 3233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final completion construction photographs.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.
   1. Submit photos by uploading to web-based project software site. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.

1.3 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time from camera.

D. File Names: Name media files with date, Project area, and sequential numbering suffix.

1.4 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Preconstruction Photographs: Before starting the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by.
   1. Flag construction limits before taking construction photographs.
   2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
   3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
   4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

C. Periodic Construction Photographs: Take 20 photographs monthly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

D. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
   1. Frequency: Take photographs monthly, on the same date each month.
   2. Vantage Points: Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:
      a. Commencement of the Work, through completion of subgrade construction.
      b. Above-grade structural framing.
      c. Exterior building enclosure.
      d. Interior Work, through date of Substantial Completion.

E. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. 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."

B. 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."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.

9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: 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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. 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.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. 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 with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable. Mark each product, material, size, color, configuration, and assembly proposed for use on project.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams that show factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
   6. Submittals received that are not clearly noted and marked as specified herein will be returned without review. Resubmit with appropriate information.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. BIM Incorporation: Develop and incorporate Shop Drawing files into BIM established for Project.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
      a. Project name and submittal number.
      b. Generic description of Sample.
      c. Product name and name of manufacturer.
      d. Sample source.
      e. Number and title of applicable Specification Section.
      f. Specification paragraph number and generic name of each item.
   3. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
   4. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
   5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 MATERIAL SAFETY DATA SHEETS (MSDS)

A. Do not include “Material Safety Data Sheets” (MSDS) with any submittals. They will not be reviewed and will be cause to return submittal unreviewed, until submittal is returned in appropriate format.

B. Contractor remains solely responsible for job site safety controls, procedures, and programs. Submit Material Safety Data Sheets directly to Owner as part of Closeout Submittals unless otherwise directed. If submitted to Architect, Architect will not review this information and will return it with no action taken.

1.8 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.
    1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
    1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM Incorporation: Incorporate delegated-design drawing and data files into BIM established for Project.
    1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as original Drawings.

1.9 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
    1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
   1. Submittals by Web-Based Project Software: Architect will indicate, on Project software website, the appropriate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 3516

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special procedures for alteration work.

1.2 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. 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.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. 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.

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

G. 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.

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

I. Retain: To keep existing items that are not to be removed or dismantled.

J. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.
   1. Schedule construction operations in sequence required to obtain best Work results.
   2. Coordinate sequence of alteration work activities to accommodate the following:
      a. Owner's continuing occupancy of portions of existing building.
      b. Other known work in progress.
      c. Tests and inspections.
   3. Detail sequence of alteration work, with start and end dates.
   4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
   5. Use of elevator and stairs.
   6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns and adjacent to restricted areas. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Access to restricted areas may not be obstructed. Plan and execute the Work accordingly.

1.4 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.
   1. Attendees: In addition to representatives of Owner, Architect, and Contractor, Owner's insurer, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
   2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
      a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
      b. Fire-prevention plan.
      c. Governing regulations.
      d. Areas where existing construction is to remain and the required protection.
      e. Hauling routes.
      f. Sequence of alteration work operations.
      g. Storage, protection, and accounting for salvaged and specially fabricated items.
      h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
      i. Qualifications of personnel assigned to alteration work and assigned duties.
      j. Requirements for extent and quality of work, tolerances, and required clearances.
      k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.
   3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
   1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
   2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
      a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
      b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
      c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:
         1) Interface requirements of alteration work with other Project Work.
         2) Status of submittals for alteration work.
         3) Access to alteration work locations.
         4) Effectiveness of fire-prevention plan.
         5) Quality and work standards of alteration work.
         6) Change Orders for alteration work.
   3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.5 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:
1. Submit alteration work subschedule within seven days of date established for commencement of alteration work.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

C. Alteration Work Program: Submit 30 days before work begins.

D. Fire-Prevention Plan: Submit 30 days before work begins.

1.6 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.
1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.
1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.7 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:
1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:
1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
   1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
   2. Secure stored materials to protect from theft.
   3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F (3 deg C) or more above the dew point.

E. Storage Space:
   1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space includes security and climate control for stored material.
   2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.8 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs.
   1. Comply with requirements specified in Section 01 3233 "Photographic Documentation."

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Owner's Removals: Before beginning alteration work, verify in correspondence with Owner that the following items have been removed:
   1. As scheduled.

D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm)or more.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
   1. Use only proven protection methods, appropriate to each area and surface being protected.
   2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
   3. Erect temporary barriers to form and maintain fire-egress routes.
   4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
   5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
   6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
   7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
   8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:
   1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
   2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. 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.

D. Utility and Communications Services:
   1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
   2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
   3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. 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 functioning properly.
   1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
   2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

F. Existing Roofing: Prior to the start of work in an area, install roofing protection.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:
   1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
   2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
      a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
   1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
   2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
   3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
   4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
   5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
   6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
      a. Train each fire watch in the proper operation of fire-control equipment and alarms.
      b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
      c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
      d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
      e. Maintain fire-watch personnel at Project site until two hours after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
   1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 01 3233 "Photographic Documentation."

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection 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 quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described 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.

B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. 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, assembly, 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).

D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and 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.

E. 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.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. 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.

J. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 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.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements 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 direction 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.

1.5 ACTION SUBMITTALS

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

B. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.6 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. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
   1. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. 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.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of commencement of work, and not less than five 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 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.
2. .

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. Distinguish source quality-control tests and inspections from field quality-control 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.

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.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. 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.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, 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.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. 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.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. 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.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

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 of size indicated.
   2. Build mockups in location indicated or, if not indicated, as directed by Architect.
   3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
   5. Demonstrate the proposed range of aesthetic effects and workmanship.
   6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   8. Demolish and remove mockups when directed unless otherwise indicated.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services. In general, these tests are either discretionary or are required by Chapter 17 of the IBC as being required to be provided by the Owner's special inspector. Contractor to verify, prior to construction, the list of tests and inspections anticipated to be provided by Owner in order to clearly define responsibilities.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Engage a qualified testing agency to perform quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
   4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.

4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.
   1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, 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 matching 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 Section 01 7300 "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

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SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Day" as used in the Contract Documents means calendar day unless otherwise specifically defined.

D. "Working Day" as used in the Contract Documents means Monday through Friday and specifically does not include Saturday, Sunday, or holidays.

E. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

F. "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."

G. "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.

H. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

I. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

J. "Provide": Furnish and install, complete and ready for the intended use.

K. "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.

1.2 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.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 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 entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

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. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

E. 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.

F. 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.

1.3 INFORMATIONAL SUBMITTALS

A. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
   1. Locations of dust-control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air-filtration system discharge.
   4. Waste-handling procedures.
   5. Other dust-control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in and Texas Accessibility Standards (TAS).

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized-steel bases for supporting posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

E. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats minimum 36 by 60 inches (914 by 1524 mm).

F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
   3. Drinking water and private toilet.
   4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
   5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

2.3 EQUIPMENT

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

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage:
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
   1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
      a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
   1. Connect temporary service to Owner's existing power source, as directed by Owner.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one land-based telephone line(s) for each field office.
   1. At each telephone, post a list of important telephone numbers.
      a. Police and fire departments.
      b. Ambulance service.
      c. Contractor's home office.
      d. Contractor's emergency after-hours telephone number.
      e. Architect's office.
      f. Engineers' offices.
      g. Owner's office.
      h. Principal subcontractors' field and home offices.

J. Electronic Communication Service: Provide the following:
   1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions with wireless connectivity.
   2. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 1.0 Mbps upload and 15 Mbps download speeds at each computer.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
   1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
   1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
   2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 requirements.
   3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
   1. Provide dedicated parking spaces for the following:
      a. One for Architect.
      b. Two for Owner.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   3. Maintain and touch up signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 7300 "Execution."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
   1. Do not load elevators beyond their rated weight capacity.
   2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

M. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 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 in order to affect 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 that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 31.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of 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.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
   1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
   2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
   3. Insulate partitions to control noise transmission to occupied areas.

4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 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 sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. 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. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
    1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
    1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
    2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
    3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 7700 "Closeout Procedures."

END OF SECTION

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SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 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 by Architect 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 single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.3 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Architect's Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 3300 "Submittal Procedures." Show compliance with requirements.

1.4 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.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.
   3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

1.5 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.

1.6 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. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 7700 "Closeout Procedures."

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 meeting 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. Products containing added asbestos are prohibited.

B. Product Selection Procedures:
1. Sole 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.
   a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: …"
2. Sole 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.
   a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: …"
3. Limited List of Products: 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 be considered unless otherwise indicated.
   a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
   a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: …"
5. Limited List of Manufacturers: 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 be considered unless otherwise indicated.
   a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
   a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: …"

7. 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.
    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500 "Substitution Procedures" for substitutions for convenience.

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 Section 01 2500 "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 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
2. Evidence that proposed product provides specified warranty.
3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
4. Samples, if requested.

B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 7300

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Installation of the Work.
   2. Cutting and patching.
   3. Coordination of Owner-installed products.
   4. Progress cleaning.
   5. Starting and adjusting.
   6. Protection of installed construction.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

1.4 INFORMATIONAL SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
   4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utilities.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 3100 "Project Management and Coordination."

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.

G. 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.

H. 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.

I. 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.

J. Repair or remove and replace damaged, defective, or nonconforming Work.
1. Comply with Section 01 7700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.4 CUTTING AND PATCHING

A. Cutting and Patching, 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 in-place 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. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 1000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place 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 neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

H. 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 practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical 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 minimize evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.
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 in-place 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, prepare substrate and apply primer and intermediate paint coats appropriate for substrate 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 in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 5000 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

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SECTION 01 7700

CLOSEOUT PROCEDURES

1.1 SUMMARY

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at final completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 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. Architect’s List of Incomplete Items: Architect will provide a list of items to be completed and corrected (Punch List). Review, indicate value of each item on list and reasons why the Work is incomplete. Submit to Architect within 10 days of receipt of list.

C. 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.
      a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
   5. Submit testing, adjusting, and balancing records.
   6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

D. Procedures Prior to Substantial Completion: Complete the following a minimum of 10days 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 7900 "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.

E. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10days 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.

1.6 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 2900 "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.

1.7 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. Web-based project software upload. Utilize software feature for creating and updating list of incomplete items (punch list).

1.8 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. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
   1. Submit on digital media acceptable to Architect.

D. 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 5000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 5000 "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 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

SECTION 01 7823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Emergency manuals.
   3. Systems and equipment operation manuals.
   4. Systems and equipment maintenance manuals.
   5. Product maintenance manuals.

1.2 DEFINITIONS

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

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

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: 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 the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: 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 and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. 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.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. 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.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: 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:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. 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.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. 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 warranties and bonds as described below.

C. Source Information: 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 and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
      a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: 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.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: 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.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

J. 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.
   1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product 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 and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 7839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and one of file prints.
         2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit PDF electronic files of scanned record prints and three set(s) of prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   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 provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.

j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
a. See Section 01 3100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
3. Identification: As follows:
a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

1.4 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. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. 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.

C. Format: Submit record Product Data as annotated PDF electronic file.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.6 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.

B. Format: Submit miscellaneous record submittals as PDF electronic file.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.7 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 7900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Qualification Data: For facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.

b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Systems and equipment operation manuals.
   c. Systems and equipment maintenance manuals.
   d. Product maintenance manuals.
   e. Project Record Documents.
   f. Identification systems.
   g. Warranties and bonds.
   h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 7823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 02 4113

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected site elements.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.
   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.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property and , for noise control. Indicate proposed locations and construction of barriers.

B. 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 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. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Predemolition Photographs or Video: Submit before Work begins.

1.6 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. 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.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Perform an engineering survey of condition of site structures 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.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
1. Comply with requirements specified in Section 01 3233 "Photographic Documentation."

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
1. Comply with requirements for existing services/systems interruptions specified in Section 01 1000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. 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.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated 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.
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.

3.3 PREPARATION

A. 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.
   1. Comply with requirements for access and protection specified in Section 01 5000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

C. Temporary Shoring: 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.

3.4 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. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   2. Dispose of demolished items and materials promptly.

B. 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.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   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.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 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

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SECTION 02 4119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

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

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. 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.

C. 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 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.
   5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 3233 "Photographic Documentation." Submit before Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.5 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. 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.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 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.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

B. 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.

C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
1. Comply with requirements specified in Section 01 3233 "Photographic Documentation."
2. 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.

3.2 PREPARATION

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

3.3 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.
   1. Arrange to shut off utilities with utility companies.
   2. 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.
   3. 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. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      d. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.4 PROTECTION

A. 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.

B. Remove temporary barricades and protections where hazards no longer exist.

3.5 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 two hour 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.

C. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site .
5. Protect items from damage during transport and storage.

D. Salvaged Materials for Reinstallation:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. 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.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. 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.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

D. 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.

E. 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.

3.7 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.

B. Burning: Do not burn demolished materials.

3.8 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 11 13
STRUCTURAL CONCRETE FORMING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Shoring, formwork and re-shoring of structure.
2. Furnish, install and removal of concrete formwork.

1.02 REFERENCES

A. Codes and Specifications
1. American Concrete Institute (ACI)
a. ACI 117, Specification for Tolerances for Concrete Construction and Materials
b. ACI 301, Specifications for Structural Concrete
c. ACI 318, Building Code Requirements for Structural Concrete
d. ACI 347R, Guide to Formwork for Concrete
2. Concrete Reinforcing Steel Institute (CRSI)
a. Manual of Standard Practice
3. American Society for Testing Materials (ASTM)
a. ASTM C203, Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
b. ASTM D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics
c. ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

1.03 SUBMITTALS

A. Shop Drawings:
1. Submit shop drawings for formwork.
2. Submit description of shoring, re-shoring and backshoring procedures, indicating magnitude of loads assumed, signed and sealed by licensed design engineer
3. Submit size and layout of sleeves and openings in structural members, required by trades, prior to releasing reinforcing, and formwork shop drawings for fabrication.

B. Construction Joints: Submit diagrams of construction joints.

C. Form Ties: For Architecturally exposed concrete, submit layout of form tie spacing.

D. Product Data:
1. Form release agent
2. Vapor retarder

E. Samples:
1. Rustication forms
2. Reglet
3. Dove-tailed anchor slots

F. Unless otherwise indicated, submit the following for each type of product provided under Work of this Section:
1. Product Disclosure:
a. If available, provide product specific Type III, third party certified, Environmental Product Declaration (EPD) for each product in which product manufacturer is explicitly recognized as a participant by program operator.
b. If available, provide third party verified Corporate Sustainability Report (CSR) for each product that covers at least 90 percent of product contents.
c. If available, provide published Health Product Declaration (HPD) for each product documenting the role, amount, and health hazards for every product ingredient.

2. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
   b. Indicate material cost of product less labor included in Project.
   c. If recycled content is part of an assembly, indicate percentage of pre-consumer and post-consumer recycled contents in assembly by weight.
3. Local / Regional Materials:
   a. Indicate extraction, manufacture, and purchase location of products; indicate distance between points of extraction, manufacture, and purchase and Project site.
   b. Indicate material cost less labor of products extracted, manufactured, and purchased within 100 miles of Project site.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store materials off ground and protected from weather.
   1. Prevent warpage, twisting and excessive moisture gain of wood materials.
   2. Discard damaged or deformed materials.

B. Protect smooth faces of form liner materials from abrasion, denting or scarring during handling.

PART 2 PRODUCTS

2.01 GENERAL

A. Design, erect, shore, brace and maintain formwork according to ACI 301 to withstand vertical, lateral, static, dynamic and construction loads applied prior to concrete structure reaching adequate strength to support such loads.

B. Limit form deflections to provide smooth, straight surfaces without unsightly bulges and deformations.

C. Limit form deformations for architecturally exposed surfaces to 0.0025 times the span of each component (facing material, studs and walers).

2.02 MATERIALS

A. Wood forms for unexposed concrete surfaces: No. 2 Southern Yellow Pine or Douglas Fir dressed to uniform and smooth contact surfaces.

B. Wood forms for concrete surfaces exposed to view: Commercial Standard Douglas Fir concrete form plywood, moisture resistant, not less than 5 plies, and minimum thickness of 9/16 inch. Line forms with one of the following:
   1. Plywood: Commercial Standard Douglas Fir, concrete form, exterior, 3 ply, not less 1/4 inch thick with one smooth face.
   2. Fiberboard: Treated, hard pressed fiberboard, moisture resistant, not less than 3/16 inch thick with one smooth side.

2.03 COMPONENTS

A. Rustications: steel, polyvinyl chloride or milled and sealed white pine.

B. Dove-tailed anchor slots: compatible with specified dove-tailed anchors for masonry veneer.

2.04 ACCESSORIES

A. Form ties: bolt rods or patented devices of sufficient strength to withstand pressure due to wet concrete (3000 pounds minimum tensile strength); adjustable in length, and removable to depth of at least 1 inch from face of concrete.
   1. Equip ties for exposed concrete surfaces with plastic cones 5/8 inch in diameter.
   2. Do not use wire ties, or makeshift ties that leave unsightly marks or depressions on face of concrete.

B. Form release agent:
   1. Does not bond with, stain, or adversely affect concrete surfaces.
   2. Meets acceptable air quality standards.

2.05 PRODUCT DOCUMENTATION

A. In coordination with Project sustainability goals, provide products with third-party certified Type III Environmental Product Declarations (EPDs) in accordance with ISO 14025 that document product's environmental impacts associated with material extraction, energy use, chemical makeup, waste generation, and emissions.

B. In coordination with Project sustainability goals, provide products with third-party verified corporate sustainability reports (CSRs) that document material supply chains and extraction operations.

C. In coordination with Project sustainability goals, provide products with published Health Product Declarations (HPDs) that document chemical inventory of product to at least 0.1 percent.

2.06 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. In coordination with Project sustainability goals, provide products with environmental impacts below industry average in the following categories:
   1. Global warming potential
   2. Depletion of stratospheric ozone layer
   3. Acidification of land and water sources
   4. Eutrophication
   5. Formation of tropospheric ozone
   6. Depletion of nonrenewable resources

B. In coordination with Project sustainability goals, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of pre-consumer recycled content constitutes at least 25 percent of total value of materials in Project.

C. In coordination with Project sustainability goals, ensure that products are sourced from manufacturers with third-party validated health, safety, and risk programs.

D. In coordination with Project sustainability goals, provide products and materials that promote good indoor environmental quality (EQ) and promote efficiencies in operational performance.

E. In coordination with Project sustainability goals, provide materials and products sourced within 100 miles of Project site.

PART 3 EXECUTION

3.01 DESIGN AND CONSTRUCTION

A. Design formwork for concrete elements to have correct dimension, shape, alignment, elevation, and position with dimensional tolerances conforming to ACI 117. Reference ACI 347R.

B. Design formwork to safely support vertical and lateral loads until such loads can be supported by concrete structure. Carry vertical and lateral loads to ground by formwork system or by in-place construction of adequate strength.

C. Form sides of concrete elements unless specifically noted or shown otherwise in the Contract Documents.
   1. Dimensional tolerances to conform to ACI 117.
   2. Repair bulges, offsets and formwork conditions that would cause beam sides to become skewed or wider than void box bottom forms prior to placing concrete.

D. Construct forms to required shapes, lines and dimensions; provide necessary studs, walers, ties, centering, molds and supports.
   1. Install forms sufficiently tight to prevent leakage of mortar.
   2. Construct forms to be easily removable without damage to finished surfaces.
   3. Provide forms without unsightly marks or deformations on exposed faces.
   4. Thoroughly clean forms of concrete laitance before re-use.
   5. Provide clean-outs at base of vertical forms for removal of foreign materials before concrete placement.

E. Tying of forms: provide sufficient form ties to prevent bulging or collapse of forms under weight of wet concrete.

1. Place ties in uniform and orderly pattern.
2. Lubricate ties to prevent bonding with concrete.

F. Special features: place in forms any wood strips, blocking, molding, and liners necessary to produce required shapes.
1. Attach feature strips to forms in a manner that will not leave unsightly marks on exposed concrete surfaces.
2. Coat wood strips, blocking and molding with form sealer.
3. Provide 3/4 inch chamfer strips along edges of permanently exposed concrete unless noted otherwise in Contract Documents.
4. Provide dove-tailed anchor slots coordinated with masonry.

G. Coatings:
1. Coat contact surfaces of wood forms with form release agent before each use and before placing reinforcement.
2. Apply form release agent per manufacturer's recommendations.
3. Do not allow excess release agent to accumulate in forms or to contact hardened concrete against which fresh concrete will be placed.
4. Remove release agent from reinforcement before placing concrete.

H. Construction joints:
1. Locate construction joints as shown on approved submittals.
a. Do not locate construction joints between lateral bracing elements of walls and columns.
b. Locate construction joints in beams, slabs and joists approximately at midspan between supports.
c. Provide plumb and level construction joints. Avoid irregular lines at horizontal construction joints in exposed concrete faces by tacking a continuous strip of dressed lumber, 1 inch thick, to inside of wall or grade beam form, with its lower edge at line of construction joint. About one hour after placing concrete in lower part of wall or grade beam, remove strip, level off irregularities in joint line with wood float and remove laitance.
d. Provide shear keys and waterstops as required in construction joints.

3.02 REMOVAL OF FORMS

A. Remove forms completely, unless specifically required otherwise.

B. Remove forms carefully to avoid damage to concrete surfaces.

C. Do not remove forms until concrete is adequately set.
1. Clamps and tie rods may be loosened after 24 hours following placement of concrete.
a. Maintain sufficient ties to hold forms in place.
b. Withdraw through-wall ties toward the inside (or unexposed) face of walls and beams.
c. Prevent spalling during tie removal.
2. Use concrete strength tests as evidence that concrete has adequately set for form removal.
a. Minimum strength is 75 percent of design strength.

D. Remove forms sequentially and in small units to prevent shock, overload or undue eccentricity in structure. Do not store materials or place heavy equipment on structures of which forms have been removed unless concrete strength is equal to design strength, or re-shores are installed. Remove forms in a manner that does not require a large portion of the structure to be self-supporting (i.e. a full bay of framing). Install re-shores immediately as form removal progresses.

E. Do not remove forms until supporting structures are permanently in place and full strength.

F. Re-shore structure required to support subsequent construction. Install re-shores plumb and tight to structure and concentric with form supports. Provide re-shore materials with safe load capacity sufficient for transfer of required loads. Re-shore sufficient levels of structure so that

imposed loads due to forms, wet concrete and construction loads do not exceed the combined live load capacity of levels to which re-shores extend. Space re-shores sufficiently close together to provide uniform distribution of load to supporting structure.

END OF SECTION

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SECTION 03 11 15
EXPANDED POLYSTYRENE FOAM BLOCK FORMWORK

PART 1 GENERAL

1.01 SUMMARY

A. Related Sections: 03 11 13 Structural Concrete Forming

1.02 REFERENCES

A. ASTM D6817 - Standard Specification for Rigid Cellular Polystyrene Geofoam

1.03 SUBMITTALS

A. Shop Drawings: Show layout and dimensions of Expanded Polystyrene (EPS) foam block fill areas. Indicate location, size, and elevation. Provide cross section of area indicating height and depth. Provide plan view of each layer of foam block with each part identified and dimensioned. Show attachment method and configuation.

B. Product Data for listed materials including:
   1. Physical properties in compliance with ASTM D6817 Type EPS15, unless noted otherwise in Contract Documents.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver EPS foam labeled with material type.

B. Prior to installation, store above ground and protected from moisture and sunlight.

C. Do not expose product to open flame or other ignition sources.

D. Do not deliver product to Project site before installation time.

E. Complete installation and concealment of product in each area of construction as rapidly as possible.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Molded, Rigid Cellular Expanded Polystyrene Blocks: Comply with manufacturer's requirements, conform to ASTM D6817.

B. Adhesive: non-solvent based polyurethane adhesive.

C. GeoGripper Plates: Use to restrain EPS Geofoam from moving laterally in layer over layer applications.
   1. Made of galvanized or stainless steel with two-sided multi-barbed design capable of piercing geofoam.

D. Treat EPS foam blocks with a tested and proven termite treatment by manufacturer for below grade applications, 3 year minimum field exposure. Use EPA registered treatment meeting requirements of ICC ES EG239 and recognized in an ICC ES report.

2.02 FABRICATION

A. Fabricate blocks square and true to dimension.
   1. Factory cut blocks for delivery to jobsite and installation without need for excessive field cutting.
   2. Ramp areas: fabricate block with slope consistent with ramp slope requirements.

B. Marking and Identification: Mark blocks with Section Layer I.D. letter and part number identification corresponding to shop drawing layout and EPS schedule.

PART 3 EXECUTION

3.01 MANUFACTURER’S INSTRUCTIONS

A. Compliance: Comply with manufacturer’s EPS foam product data; including technical bulletins.

3.02 STORAGE

A. Ballast: Ballast EPS foam to prevent displacement by wind or high water conditions during storage and placement.

3.03 GENERAL INSTALLATION

A. Examine supporting substrate and abutting structural framing for compliance with requirements for elevations, installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions are corrected.

B. Install system in compliance with Contract Documents and installation/shop drawings as prepared by manufacturer.

C. Blocks to be adhered to base slab and to one another along horizontal surface with continuous minimum 1 inch wide strip of adhesive. Adhesive to be placed 2 inches from perimeter of each side of each block and at 8 inches on center each way.

D. Installation to be completed by experienced craftsmen trained to do this type of Work.

3.04 PROTECTION & SAFETY

A. Protection: Protect installed product and finish surfaces from damage during construction.

B. Do not weld with torch in same room as installed or stored EPS. Protect EPS against ignition.

END OF SECTION

SECTION 03 15 00

CAST-IN ANCHORS AND EMBEDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Steel assemblies to be embedded
2. Anchors
3. Inserts

1.02 REFERENCES

A. Codes and Specifications
1. Concrete Reinforcing Steel Institute (CRSI)
a. Manual of Standard Practice.
2. American Institute of Steel Construction (AISC)
a. AISC 360, Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
3. American Welding Society (AWS)
a. AWS D1.1, Structural Welding Code - Steel.
b. AWS D1.4, Structural Welding Code - Reinforcing Steel.
c. AWS D1.8, Structural Welding Code – Seismic Supplement
4. American Concrete Institute (ACI)
a. ACI 318, Building Code Requirements for Reinforced Concrete.
b. SP-066, ACI Detailing Manual
5. American Society for Testing and Materials (ASTM)
a. ASTM A36, Standard Specification for Carbon Structural Steel.
b. ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
c. ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
d. ASTM A283, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
e. ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
f. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
g. ASTM A706, Standard Specification for Deformed and Plain Low-Alloy 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 A1011, 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.
j. ASTM F3125, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

1.03 SUBMITTALS

A. Product Data
1. Submit manufacturer's data indicating product compliance for the following:
a. Headed stud anchors
b. Deformed bar anchors
c. Rust inhibitor
d. Zinc coating
e. Threaded inserts

f. Anchor slots

B. Shop Drawings:
1. Submit shop and installation drawings for review by Architect, including:
a. Shop and field connection details
b. Material grades and sizes
c. Details of fabrication
2. Do not begin fabrication prior to review of shop drawings.
3. Review of shop drawings is for member sizes, spacings, detail, and general compliance with Contract Documents only.
4. Material quantities, lengths, fit, verification of job conditions, and coordination with other trades are responsibility of Contractor.

C. When requested by Owner or Architect, submit welders' certifications.

D. Unless otherwise indicated, submit the following for each type of product provided under Work of this Section:
1. Product Disclosure:
a. If available, provide a product specific Type III, third party certified, Environmental Product Declaration (EPD) for each product in which product manufacturer is explicitly recognized as a participant by program operator.
b. If available, provide a third party verified Corporate Sustainability Report (CSR) for each product that covers at least 90 percent of product contents.
c. If available, provide a published Health Product Declaration (HPD) for each product documenting role, amount, and health hazards for every product ingredient.
2. Recycled Content:
a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
b. Indicate material cost of product less labor included in project.
c. If recycled content is part of an assembly, indicate percentage of pre-consumer and post-consumer recycled contents in assembly by weight.
3. Local / Regional Materials:
a. Indicate location of extraction, manufacture, and purchase of products; indicate distance between points of extraction, manufacture, and purchase and Project site.
b. Indicate material cost less labor of products extracted, manufactured, and purchased within 100 miles of Project site.

1.04 QUALITY ASSURANCE

A. Qualifications
1. Fabricator:
a. Minimum of 3 years of experience in related or similar work.
2. Welders:
a. Certified for type of welding required within previous 6 months.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store fabricated assemblies and inserts under cover and off ground to protect against corrosion prior to placement.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel
1. W Shapes and WT’s: ASTM A992
2. Angles, Channels, Plates and Rods: ASTM A36.
3. Steel straps: ASTM A283 or A1011.
4. Bolts: ASTM A307, with regular hexagon nuts and carbon steel washers.

5. High Strength Bolts: ASTM F3125.

B. Reinforcing Bars
1. Deformed Bars: ASTM A615 of required grades.
2. Welded Wire Reinforcement: Conform to ASTM A1064.
3. Bars to be welded: ASTM A706 of required grades..

C. Fusion Welded Anchors
1. Headed Stud Anchors: Conform to ASTM A108, Grades 1010 through 1020, with sizes and lengths as shown in Contract Documents, and conforming to AWS D1.1, Section 7.
2. Deformed Bar Anchors: Low carbon steel, conforming with ASTM A1064, with sizes and lengths as shown in Contract Documents.
a. Example product: Type DA, as manufactured by Blue Arc Stud Welding Division of Erico Industries.

D. Welding Electrodes:
1. Conform to AISC and AWS Specifications
2. Use E70 electrodes unless noted otherwise.
3. Use E80 electrodes for welding of ASTM A706 rebar.

E. Coatings
1. Rust Inhibitor:
a. Example product: Hi-Build Epoxoline as manufactured by Tnemec Co.
2. Hot-dip Galvanizing: Conform to ASTM A153.
3. Cold Galvanizing:
a. Example product: Galvilite as manufactured by ZRC WORLDWIDE

F. Inserts
1. Threaded Inserts: Rated for tensile strength of bolt size given in Contract Documents (ultimate strength).
2. Anchor Slots to receive inserts for anchoring masonry units, cast stone, and marble to concrete: One inch wide, 7/8 inch deep, continuous No. 24 gauge, galvanized sheet steel, dovetailed slots, complete with felt lining.
a. Example manufacturer: Hohmann & Barnard, Inc., New York, N.Y.
3. Miscellaneous: PVC pipes, or other special inserts as shown in Contract Documents, or as required by other trades.

2.02 PRODUCT DOCUMENTATION

A. In coordination with Project sustainability goals, provide products with third-party certified Type III Environmental Product Declarations (EPDs) in accordance with ISO 14025 that document product’s environmental impacts associated with material extraction, energy use, chemical makeup, waste generation, and emissions.

B. In coordination with Project sustainability goals, provide products with third-party verified corporate sustainability reports (CSRs) that document material supply chains and extraction operations.

C. In coordination with Project sustainability goals, provide products with published Health Product Declarations (HPDs) that document chemical inventory of product to at least 0.1%.

2.03 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. In coordination with Project sustainability goals, provide products with environmental impacts below industry average in the following categories:
1. Global warming potential
2. Depletion of stratospheric ozone layer
3. Acidification of land and water sources
4. Eutrophication
5. Formation of tropospheric ozone
6. Depletion of nonrenewable resources

B. In coordination with Project sustainability goals, provide materials with recycled content such that sum of post-consumer recycled content plus one-half of pre-consumer recycled content constitutes at least 25 percent of total value of materials in Project.

C. In coordination with Project sustainability goals, ensure that products are sourced from manufacturers with third-party validated health, safety, and risk programs.

D. In coordination with Project sustainability goals, provide products and materials that promote good indoor environmental quality (EQ) and promote efficiencies in operational performance.

E. In coordination with Project sustainability goals, provide materials and products that are sourced within 100 miles of Project site.

2.04 FABRICATION

A. Fabricate and assemble structural steel items in shop. Carefully and accurately shear, flame cut, and chip materials as required. Cut, drill, or punch holes at right angles to surface of metal. Do not enlarge holes by burning. Cut holes cleanly without torn or ragged edges. Weld in accordance with AISC Specifications and with AWS D1.1 and D1.4. Permit only AWS certified welders to perform welds.

B. Weld deformed bar anchors and headed stud anchors by full-fusion process. Weld in accordance with manufacturer's recommendations regarding equipment, conditions of material, and temperature.
   1. Example processes:
      a. Nelson Stud Welding Company
      b. KSM Welding Services Division, Omark Industries.

C. Hot-dip galvanize steel assemblies and accessories exposed to weather or soil. Hot-dip galvanize steel embeds used within crawl space environments.

D. Plainly mark and match-mark assemblies and inserts to correspond to placement drawings and diagrams.

PART 3 EXECUTION

3.01 INSTALLATION

A. Clean assemblies and inserts of corrosion, dirt, oil, grease and laitance before placing in forms.

B. Place assemblies and inserts in forms and securely anchor in required positions with correct orientations. Use templates, diagrams and instructions provided by Fabricator for proper alignment and positioning.

3.02 FIELD QUALITY CONTROL

A. Laboratory Testing: provide independent testing laboratory services as follows:
   1. Inspect steel fabrications for sizes, spacings and general quality of fabrication.
   2. Inspect welding of steel fabrications for size, length and quality.
   3. Inspect positioning of assemblies and inserts in forms.
   4. Visually inspect welds at anchors and shear stud connectors. Test studs which do not appear to have full sound 360 degree fillet weld at base. Test by bending 15 degrees. Replace studs which fail this test.

B. Afford full cooperation and access to Work to testing laboratory and provide adequate notice to laboratory of when Work is ready for testing and inspection so that services can be carried out in full, allowing sufficient time for making corrections without delaying progress of Work.

3.03 ADJUSTING

A. Field Touch Up
   1. Use cold galvanizing compound in accordance with manufacturer's recommendations for field touch-up.

END OF SECTION

SECTION 03 2000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Preparation of shop drawings
   2. Fabrication and placement of reinforcing

B. Products Furnished, not Installed Under This Section
   1. Pier reinforcing

1.02 REFERENCES

A. Codes and Specifications
   1. American Concrete Institute (ACI)
      a. ACI 318, Building Code Requirements for Reinforced Concrete
      b. SP-066, ACI Detailing Manual
   2. Concrete Reinforcing Steel Institute (CRSI)
      a. Manual of Standard Practice
      b. RB4.1, Supports for Reinforcement Used in Concrete
   3. American Welding Society (AWS)
      a. AWS D1.1, Structural Welding Code - Steel
      b. AWS D1.4, Structural Welding Code - Reinforcing Steel
   4. American Society for Testing Materials (ASTM)
      a. ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
      b. ASTM A1044, Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete
      c. ASTM A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
      d. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
      e. ASTM A706, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
      f. ASTM A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars
      g. ASTM A767, Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
      h. ASTM A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
      i. ASTM D3963, Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars

1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop and installation drawings for review by Architect, including:
      a. Reinforcing sizes and quantities
      b. Reinforcing lengths and bending details
      c. Placement instructions
      d. Details and spacing of reinforcing supports
      e. References to reinforcing designations in Contract Documents
      f. Notes regarding reinforcing placement in Contract Documents
      g. Material grades
   2. Review of Shop Drawings will be for reinforcing sizes, spacing, and general detail only; excluding quantities, lengths and fit of materials.
   3. Do not use reproductions of Contract Documents for shop drawings.

B. Quality Control Submittals

1. Submit certified mill reports, evidencing compliance with Specification requirements.
2. Submit laboratory testing and inspection reports.

C. Unless otherwise indicated, submit the following for each type of product provided under Work of this Section:
   1. Product Disclosure:
      a. If available, provide product specific Type III, third party certified, Environmental Product Declaration (EPD) for each product in which product manufacturer is explicitly recognized as a participant by program operator.
      b. If available, provide third party verified Corporate Sustainability Report (CSR) for each product that covers at least 90 percent of product contents.
      c. If available, provide published Health Product Declaration (HPD) for each product documenting role, amount, and health hazards for every product ingredient.
   2. Recycled Content:
      a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
      b. Indicate material cost of product less labor included in Project.
      c. If recycled content is part of an assembly, indicate percentage of pre-consumer and post-consumer recycled contents in assembly by weight.
   3. Local / Regional Materials:
      a. Indicate extraction, manufacture, and purchase location of products; indicate distance between points of extraction, manufacture, and purchase and Project site.
      b. Indicate material cost less labor of products extracted, manufactured, and purchased within 100 miles of Project site.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in tagged bundles grouped by reinforcing size and length.

B. Store reinforcing on skids off ground and stacked to permit drainage. Prevent build-up of rust and dirt on reinforcing. Protect reinforcing from contamination that would prevent bonding of concrete.

C. Do not bend, twist or warp reinforcing during handling.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel
   1. Deformed bars: new billet steel conforming to ASTM A615 of required grades.
   2. Smooth bars: conform to ASTM A615
   3. Welded wire reinforcement: conform to ASTM A1064.
   4. Reinforcing bars to be welded: conform to ASTM A706.

2.02 MANUFACTURED UNITS

A. Provide manufactured units conforming to ACI 318 and capable of developing 125 percent of yield strength of bar, unless noted otherwise.

B. Full-tension sleeve bar splices: sleeve with ferrous filler
   1. Example product: Cadweld Rebar Splice C-Series by Erico Products

C. Compression sleeve splice: sleeve with ferrous filler
   1. For use where compression lap splices are not permitted.
   2. Example product: Cadweld Rebar Splice Series C-16

D. Compression bar splice: bolted sleeve
   1. For use where compression lap splices are allowed.
   2. Example product: Erico Speed Sleeve

E. Mechanical couplings: taper-threaded hexagonal steel couplers.
   1. Provide end caps for future construction applications.

2. Example product:
   a. Lenton Rebar Splicing System by Erico Products.
   b. BarGrip XL by BarSplice Products.

2.03 ACCESSORIES

A. Concrete bricks or chairs with bearing plates: Provide where supports are in contact with soil or vapor barrier.

B. Plastic-tipped chairs in conformance with CRSI RB4.1.Provide of suitable color where concrete soffits will be exposed to view.

2.04 BAR COATINGS

A. Epoxy Coating: conform to ASTM A775, ASTM D3963.

B. Hot-dip galvanizing: conform to ASTM A767.

2.05 PRODUCT DOCUMENTATION

A. In coordination with Project sustainability goals, provide products with third-party certified Type III Environmental Product Declarations (EPDs) in accordance with ISO 14025 that document product's environmental impacts associated with material extraction, energy use, chemical makeup, waste generation, and emissions.

B. In coordination with Project sustainability goals, provide products with third-party verified corporate sustainability reports (CSRs) that document material supply chains and extraction operations.

C. In coordination with Project sustainability goals, provide products with published Health Product Declarations (HPDs) that document chemical inventory of product to at least 0.1 percent.

2.06 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. In coordination with Project sustainability goals, provide products with environmental impacts below industry average in the following categories:
   1. Global warming potential
   2. Depletion of stratospheric ozone layer
   3. Acidification of land and water sources
   4. Eutrophication
   5. Formation of tropospheric ozone
   6. Depletion of nonrenewable resources

B. In coordination with Project sustainability goals, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of pre-consumer recycled content constitutes at least 25 percent of total value of materials in Project.

C. In coordination with Project sustainability goals, ensure that products are sourced from manufacturers with third-party validated health, safety, and risk programs.

D. In coordination with Project sustainability goals, provide products and materials that promote good indoor environmental quality (EQ) and promote efficiencies in operational performance.

E. In coordination with Project sustainability goals, provide materials and products sourced within 100 miles of Project site.

2.07 FABRICATION

A. Shop Fabrication
   1. Cut reinforcing to required lengths
   2. Bend reinforcing cold with suitable equipment. Do not heat or stretch material. Provide bend radii and extensions in conformance with ACI 318.
   3. Do not use reinforcing with kinks or unrequired bends.
   4. Do not re-straighten reinforcing bent more than 30 degrees.

B. Tolerances: conform to ACI 318.

C. Marking: mark reinforcing to correspond with shop drawings.

D. Provide uncoated bars unless noted otherwise in Contract Documents.

2.08 SOURCE QUALITY CONTROL

A. Testing Laboratory Services
   1. Inspect fabricating and bending procedures
   2. Inspect fabricated materials

PART 3 EXECUTION

3.01 PREPARATION

A. Clean reinforcing of ice, dirt, loose rust, mill scale, oil, and grease.

B. Repair of damaged epoxy coating: conform to ASTM D3963

C. Repair of damaged galvanizing: conform to ASTM A780
   1. Example product: Galvilite by ZRC Worldwide

3.02 PLACEMENT

A. Place reinforcing of required sizes and quantities in proper position within forms. Use supports and spacers to maintain position before and during concrete placement.
   1. Do not place reinforcing supports against exposed faces of precast panels, beams, walls or copings.
   2. Support concrete reinforcing in conformance with CRSI RB4.1

B. Secure reinforcing in position with wire ties complying with ACI 318.
   1. Clip or bend tails of tie wire away from exposed faces, do not leave tie wire within 1 1/2" of any exposed surface.

C. Concrete Cover: comply with ACI 318 and Contract Documents.

D. Tolerances
   1. Concrete cover to unformed surfaces
      a. Members 8 inches deep or less: plus 1/4 inch
      b. Members more than 8 inches deep: plus 1/2 inch
   2. Concrete cover to formed surfaces: plus 1/4 inch
   3. Longitudinal location of bends and ends of reinforcement: plus 2 inches
   4. Spacing between reinforcing bars: 1/4 inch

E. Support reinforcing in slabs-on-grade and slabs-on-deck on bolsters or blocks. Do not lift reinforcing during concrete placement.

3.03 COLD BENDING OF BARS IN FIELD

A. Dowels connecting concrete of different pour sequences may be bent in field to facilitate form placement and removal with the following conditions:
   1. Maximum bar size is #5
   2. Maximum bend angle is 90 degrees
   3. Bars may be bent and straightened one time only

3.04 FIELD QUALITY CONTROL

A. Testing Laboratory Services
   1. Inspect reinforcing sizes, quantities and placement.
   2. Inspect support and securement of reinforcing.
   3. Inspect condition of reinforcing.

END OF SECTION

SECTION 03 3035

UNDER SLAB SHEET VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Sheet materials for controlling vapor diffusion through concrete slabs-on-grade.

1.2 SUBMITTALS

A. Written certification from the manufacturer that the materials and their application as noted in this Specification and on the Drawings is appropriate and approved for this project.

B. Product Data: Manufacturer's product data, specifications, and installation instructions. Include vapor barrier manufacturer's requirements for placement, seaming and pipe book installation.

C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

D. Submit evidence that Installer’s existing company has minimum of 5-years continuous experience in application of specified materials.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer (applicator) who is acceptable to manufacturer, who has completed applications similar in material and extent to that required for this Project, and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Vapor Barrier and components to be from one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and application.

B. Store materials in a clean dry location in accordance with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

C. Stack membrane on elevated wood platform to eliminate warping.

D. Protect materials during handling and application to prevent damage or contamination.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting materials performance. Do not apply on frozen ground.

B. Close areas to traffic during application and for time period after application recommended in writing by manufacturer.

1.6 COORDINATION

A. Coordinate placement of sheet vapor barrier with Division 03 sections.

B. Coordinate placement of sealer and hardener with Division 03 sections and with requirements of finish flooring products, including adhesives, specified in Division 09 Sections.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sheet Vapor Barrier:
1. Type: 15 mil polyolefin film meeting requirements of ASTM E 1745, Class A.
2. Performance Requirements:
a. Maintain permeance of less than 0.01 Perms grains/(ft^2 · hr · inHg) as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
b. Strength: ASTM E 1745: Class A.

3. Provide third party documentation that testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Products: Subject to compliance with requirements, provide one of the following:
1. Fortifiber Building Systems Group; Moistop Ultra 15.
2. Meadows, W. R., Inc.; Perminator 15 mil.
3. Raven Industries Inc.; VaporBlock 15.
4. Stego Industries, LLC; Stego Wrap 15 mil Class A.

C. Basis-of-Design Product: Stego Industries, LLC; Stego Wrap 15 mil Class A.

D. Accessories:
1. Bonding Agent: Manufacturer's approved or recommended vapor barrier bonding agent.
2. Sealing and Seaming Tape: High density polyethylene tape a minimum of 4 inches in width, compatible with vapor barrier membrane, and manufactured by or recommended by vapor barrier membrane manufacturer. Tape for joints shall have at least the same permeability rating as the vapor barrier specified.
3. Vapor Proofing Mastic: Manufacturer's approved or recommended vapor proofing mastic with the same permeability rating as the vapor barrier specified.
4. Pipe Boot: Construct pipe boots from vapor barrier material and pressure sensitive tape in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 PREPARATION

A. Level or tamp or roll aggregate, sand or granular base.

3.3 INSTALLATION

A. Vapor Barrier:
1. Place, protect, and repair vapor barrier sheets according to ASTM E 1643 and manufacturer's written instructions.
2. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete pour.
3. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the slab using Stego Crete Claw Tape, per manufacturer's instructions.
a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw Tape with a surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.
4. Install vapor barrier without tears, voids, and holes. Lap ends and edges as recommended by manufacturer, but not less than 6 inches over adjacent sheets. Seal laps with tape.
5. Turn up sheets at perimeter, at footings and vertical walls, and against penetrations, and seal joints with tape.
6. Seal joints, tears, holes, perimeter, and penetrations through vapor with tape in accordance with manufacturer's recommendations.
7. Point exposed edges with pointing mastic to prevent water from traveling under membrane.
8. Adhere membrane to vertical surfaces with adhesive.

3.4 PROTECTION

A. Protect complete membrane from damage. Prior to pouring concrete, inspect membrane for punctures or damage and repair as required to maintain vapor barrier integrity.

END OF SECTION

SECTION 03 3100
STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Design of concrete mixes
2. Furnishing and placing cast-in-place concrete
3. Curing and finishing of concrete
4. Waterstops
5. Non-shrink grout

B. Products Furnished, not Installed, under this Section
1. Concrete for drilled piers

1.02 REFERENCES

A. American Concrete Institute (ACI)
1. ACI 117, Specification for Tolerances for Concrete Construction and Materials
2. ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. ACI 213, Guide for Structural Lightweight – Aggregate Concrete
4. ACI 214, Guide to Evaluation of Strength Test Results of Concrete
5. ACI 301, Specifications for Structural Concrete
6. ACI 302.1, Guide to Concrete Floor and Slab Construction
7. ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete
8. ACI 305.1, Specification for Hot Weather Concreting
9. ACI 306.1, Standard Specification for Cold Weather Concreting
10. ACI 308, Guide to External Curing of Concrete
11. ACI 309, Guide for Consolidation of Concrete
12. ACI 318, Building Code Requirements for Structural Concrete and Commentary
13. MNL-15, Field Reference Manual

B. American Society for Testing and Materials (ASTM)
1. ASTM C31, Standard Method of Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33, Standard Specification for Concrete Aggregates.
3. ASTM C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42, Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94, Standard Specification for Ready-Mixed Concrete.
6. ASTM C138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
7. ASTM C143, Standard Test Method for Slump of Portland Cement Concrete.
8. ASTM C150, Standard Specification for Portland Cement.
9. ASTM C156, Standard Test Method for Water Retention by Concrete Curing Materials.
10. ASTM C171, Standard Specification for Sheet Materials for Curing Concrete.
11. ASTM C172, Standard Method of Sampling Fresh Concrete.
12. ASTM C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
13. ASTM C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C260, Standard Specification for Air- Entraining Admixtures for Concrete.
15. ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete.

17. ASTM C494, Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C567, Test for Unit Weight of Structural Lightweight Concrete.
19. ASTM C618, Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
20. ASTM C989, Standard Specification for Slag Cement for Use in Concrete and Mortars.
21. ASTM C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
22. ASTM C1064, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
23. ASTM C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
24. ASTM C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
25. ASTM C1602, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
26. ASTM E1155, Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number" System (Inch-Pound) Units.
27. ASTM E1745, Standard Specification for Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

C. Corps of Engineers (CRD)
1. CRD-C13, Standard Specification for Air- Entraining Admixtures for Concrete.
2. CRD-C572, Specifications for Polyvinyl Chloride Water Stops.
3. CRD-C621, Corps of Engineers Specification for Non-Shrink Grout.

1.03 SUBMITTALS

A. Product Data: submit manufacturer’s data indicating product compliance for the following:
1. Admixtures
2. Floor hardener
3. Curing compound
4. Curing and Sealing compound
5. Vapor Retarder
6. Waterstops
7. Non-shrink grout

B. Material Certifications: submit certifications showing compliance for the following:
1. Portland cement
2. Fly ash
3. Slag cement
4. Sieve analyses for structural concrete aggregates:
   a. Coarse aggregate
   b. Fine aggregate

C. Structural Concrete Mix Designs for each class of concrete

D. Concrete Delivery Tickets: Submit sample ready-mixed concrete delivery tickets in accordance with ASTM C94 for each class of concrete.

E. Construction Joints: submit drawings indicating proposed construction joint locations.

F. Unless otherwise indicated, submit the following for each type of product provided under Work of this Section:
1. Product Disclosure:
   a. If available, provide product specific Type III, third party certified, Environmental Product Declaration (EPD) for each product in which product manufacturer is explicitly recognized as a participant by program operator.
   b. If available, provide third party verified Corporate Sustainability Report (CSR) for each product that covers at least 90 percent of product contents.

c. If available, provide published Health Product Declaration (HPD) for each product documenting role, amount, and health hazards for every product ingredient.

2. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
   b. Indicate material cost of product less labor included in Project.
   c. If recycled content is part of an assembly, indicate percentage of pre-consumer and post-consumer recycled contents in assembly by weight.
3. Local / Regional Materials:
   a. Indicate extraction, manufacture, and purchase location of products; indicate distance between points of extraction, manufacture, and purchase and Project site.
   b. Indicate material cost less labor of products extracted, manufactured, and purchased within 100 miles of Project site.

1.04 QUALITY ASSURANCE

A. Batch Plant Qualifications: Conform to National Ready-Mixed Concrete Association certification requirements.

1.05 DELIVERY, STORAGE AND HANDLING

A. Transporting: Ready-mixed concrete supplier to have sufficient capacity and adequate facilities to provide continuous delivery at rate required for continuous placement throughout sequence of placement.

B. Storage of Materials
   1. Store cement in weather tight buildings or bins which prevent intrusion of moisture or contaminants. Store different types of cement in separate facilities.
   2. Stockpile aggregates to prevent segregation and contamination with other materials. Thaw frozen aggregates before use.
   3. Drain sand to uniform moisture content before use.
   4. Store admixtures securely to prevent contamination, evaporation, damage or temperature variation in excess of range recommended by manufacturer.
   5. Store waterstops under cover to prevent exposure to sunlight, moisture, soil and other deleterious materials.

C. Delivery: Truck mixers, agitators and non-agitating units: Conform to ASTM C94

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Ardex Americas
B. Dayton Superior
C. Euclid Chemical Company
D. W.R. Grace & Company
E. SpecChem
F. BASF
G. W.R. Meadows
H. Sika Corporation
I. Sonneborn

2.02 MATERIALS

A. Cementitious materials
   1. Portland cement: Conform to ASTM C150, Type I, II or III Portland Cement.
   2. Fly Ash: Conform to ASTM C618, carbon content not greater than 3 percent by volume.
   3. Slag Cement: Conform to ASTM C989.

B. Fine aggregate: Conform to ASTM C33, natural bank or river sand, washed and screened, consisting of hard, durable, uncoated particles free of deleterious matter, and graded from coarse to fine to produce a minimum percentage of voids.

C. Coarse aggregate: Conform to ASTM C33, gravel or crushed stone, suitably processed, washed and screened; consisting of hard, durable particles without adherent coatings.

D. Coarse aggregate for lightweight concrete: Conform to ASTM C330, expanded clay or shale, producing a minimum split cylinder ratio of 5.0.

E. Water: Conform to ASTM C1602.

F. Admixtures: Conform to ASTM C494, Type A through G, and used strictly in accordance with manufacturer's recommendations.

G. Air Entraining Admixtures: Conform to ASTM C260 and CRD-C13.

H. Calcium chloride thiocyanates or admixture containing more than 0.05 percent chloride ions not permitted in concrete mixtures.

I. Admixtures containing chlorides not permitted in concrete poured on metal floor deck, nor in post-tensioned concrete.

2.03 CURING AND FINISHING PRODUCTS

A. Liquid Curing Compound
   1. Conform to ASTM C309, Types 1 and 1D, Class B
   2. Meet federal and state VOC/AIM regulations.
   3. Dissipating resin type, which chemically breaks down after approximately 8 weeks.
   4. Does not inhibit bonding of flooring adhesives.
   5. Does not inhibit bond breaker, where applicable.
   6. Sodium silicates prohibited.
   7. Use on interior slabs receiving subsequent floor coverings and parking structures.

B. Curing and Sealing Compounds:
   1. Conform to ASTM C1315, Type 1, Class A.
   2. Minimum 25 percent solids by volume.
   3. Moisture loss not more than 0.30 Kg/M2 when applied at 300 square feet per gallon.
   4. Meet federal and state VOC/AIM regulations
   5. Do not use in tilt-up construction

C. Evaporation Retardant:
   1. Thin, continuous film which prevents rapid moisture loss from concrete surface.
   2. Use in concrete operations performed in direct sun, wind, or high temperatures.

D. Waterproof Paper:
   1. Waterproof paper for curing concrete: 2 ply fiber-reinforced, asphaltic kraft paper conforming to ASTM C171.

E. Abrasive Aggregate: aluminum oxide aggregate

F. Floor Hardener:
   1. Penetrating liquid for subsequent application
   2. Non-staining
   3. Combination curing compound and hardener not permitted.

G. Cement Floor Leveling Compound: Free flowing, self-leveling, pumpable, cementitious compound specially formulated for feather-edge application.

H. Liquid Densifier / Sealer:
   1. Siliconate based sealer that penetrates concrete surfaces, increases abrasion resistance, and provides a "low sheen" surface.
   2. Clear, non-yellowing, fast curing, chemically neutral, without oils, fillers, extenders and stabilizers.
   3. Does not inhibit bonding of flooring adhesives.

4. Does not inhibit bond breaker, where applicable.

I. Comply with applicable air-quality and environmental regulations.

2.04 MISCELLANEOUS PRODUCTS

A. Waterstops:
1. Bulb Type Waterstops
a. Flexible PVC (polyvinyl chloride) extruded from elastomeric plastic material of which basic resin is prime virgin polyvinyl chloride containing no scrap material, reclaimed material or pigment; ribbed, with center bulb and 3/8 inch thickness at base, 6 inch long cross-section. Example product:
1) Greenstreak/Sika #705
2) Southern Metals #15RCB
3) Vinylex #RB638
b. Provide factory made waterstop fabrications for changes of direction, intersections, and transitions, leaving only straight butt joint splices for field.
c. Provide grommets, pre-punched holes, or hog rings spaced at 12 inches on center along length of waterstop.
d. Provide Teflon-coated thermostatically controlled waterstop welding irons for field butt splices.
2. Adhered Waterstops
a. Strip-applied waterstop comprised of a single component, self-sealing mastic. Example product:
1) Greenstreak/Sika Lockstop
2) Southern Metals Stop-Tite
3) Vinylex UltraStop
4) Synko-Flex SF302
b. Provide manufacturer’s compatible primer adhesive to secure waterstop to concrete
c. When required, provide concrete nails in addition to primer adhesive to secure waterstop in vertical applications.
3. Expanding Waterstops
a. Strip-applied, swelling waterstop utilizing high sodium-bentonite content. Example product:
1) Volclay Waterstop-RX

B. Non-Shrink Grout:
1. Pre-mixed, non-shrinking, high strength grout
2. Compressive strength in 28 days: 5000 psi minimum at 28 days, but not less than specified strength of base concrete.
3. Conform to ASTM C1107 and CRD-C621.
4. Non-oxidizing if permanently exposed to view
5. Exhibits positive expansion when testing in accordance with ASTM C1090.
6. Example products:
a. Euco N-S Grout, manufactured by Euclid Chemical Co.
b. Masterflow 713, manufactured by Master Builders Co.
c. SikaGrout 212, manufactured by Sika Corporation.
7.

2.05 PRODUCT DOCUMENTATION

A. In coordination with Project sustainability goals, provide products with third-party certified Type III Environmental Product Declarations (EPDs) in accordance with ISO 14025 that document product’s environmental impacts associated with material extraction, energy use, chemical makeup, waste generation, and emissions.

B. In coordination with Project sustainability goals, provide products with third-party verified corporate sustainability reports (CSRs) that document material supply chains and extraction operations.

C. In coordination with Project sustainability goals, provide products with published Health Product Declarations (HPDs) that document chemical inventory of product to at least 0.1 percent.

2.06 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. In coordination with Project sustainability goals, provide products with environmental impacts below industry average in the following categories:
   1. Global warming potential
   2. Depletion of stratospheric ozone layer
   3. Acidification of land and water sources
   4. Eutrophication
   5. Formation of tropospheric ozone
   6. Depletion of nonrenewable resources

B. In coordination with Project sustainability goals, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of pre-consumer recycled content constitutes at least 25 percent of total value of materials in Project.

C. In coordination with Project sustainability goals, ensure that products are sourced from manufacturers with third-party validated health, safety, and risk programs.

D. In coordination with Project sustainability goals, provide products and materials that promote good indoor environmental quality (EQ) and promote efficiencies in operational performance.

E. In coordination with Project sustainability goals, provide materials and products sourced within 100 miles of Project site.

2.07 CONCRETE MIXES

A. General: Compose concrete of cementitious materials, fine aggregate, coarse aggregate, water, and admixtures where applicable. Design concrete mixes to be workable and appropriate for each application, to bond readily to reinforcement, without segregation or formation of excessive free water on surfaces.

B. Strength Gain: design concrete mixes to obtain required strength in 28 days or less from date of placement.

C. Selection of Proportions
   1. Determine ingredient proportions in accordance with ACI 301 to provide required strength, slump, resistance to weathering, placeability, durability and surface hardness for each class of concrete.
   2. Provide admixtures as required or appropriate to enhance workability, control set or improve strength.
   3. Minimum Cement Content: Cement content not less than 320 pounds per cubic yard
   4. Supplementary cementitious materials (fly ash and slag cement)
      a. Percentage of supplementary cementitious materials not to exceed 25 percent of total cementitious content by weight
      b. Fly ash not permitted in architecturally exposed concrete
      c. Supplementary cementitious materials not permitted in concrete receiving dry shake floor hardeners

D. Required Average Strength for Mix Design:
   1. Where suitable strength test records for concrete production facility are available, design strength may be based on standard deviation in accordance with ACI 301.
   2. Where strength test records are not available, base design strength on the following:
   3.
   4. Specified Strength Required Average Strength
   5. F'c - psi F'cr - psi
   6. ---------- ----------
   7. F'c <3000 F'c + 1000
   8. 3000 <= F'c <=5000 F'c + 1200

9. F'c > 5000 1.10 F'c + 700
10.

E. Documentation of Average Strength: provide evidence of average strength for each class of concrete in accordance with ACI 301 by field strength tests, strength test records or trial mixtures.

F. Concrete Mix Designs: submit mix designs for each class of concrete.
   1. Indicate the following for each mix design:
      a. Class designation
      b. Proportions of cement, supplementary cementitious materials, fine and coarse aggregates, and water
      c. Water-cement ratio, design strength, slump, and air content
      d. Type of cement, supplementary cementitious materials and aggregates
      e. Type and dosage of admixtures
   2. Adjust mix designs as required by weather and jobsite conditions to maintain specified strengths throughout course of Work without additional cost to Owner.
   3. As strength data becomes available during progress of Work, mix designs may be adjusted in accordance with ACI 301.
   4. Provide mix with target slump not to exceed 8 inches with no visible signs of segregation.

2.08 PRODUCTION OF CONCRETE

A. Do not mix concrete for placement until:
   1. Mix designs and corresponding strength tests reflect that each proposed mix will develop strengths required
   2. Mix designs have been reviewed for compliance.

B. Batching and Mixing:
   1. Batch and mix ready-mixed concrete in accordance with ASTM C94.
   2. Batch site-mixed concrete with scales accurate to within 0.4 percent of their total capacities. Consistently measure ingredients within 1 percent for concrete and water, 2 percent for aggregates and 3 percent for admixtures during operation of batching equipment. Mix site-batched concrete in accordance ACI 301.

C. Admixtures: Charge air-entraining admixtures and other chemical admixtures into mixer as solutions and accurately measure by means of a mechanical dispenser. Consider solution as part of mixing water.

2.09 SOURCE QUALITY CONTROL

A. Laboratory Inspection
   1. Verify required plant certifications
   2. Inspect batching equipment periodically
   3. Inspect batching and loading of transit-mix trucks at start of each production day.

B. Materials Testing
   1. Sieve analysis of aggregates

PART 3 EXECUTION

3.01 PREPARATION

A. Do not begin delivery of concrete materials until formwork, reinforcement, and embedded items are complete, properly positioned and secured in place.
   1. Remove snow, ice, debris and excessive water from forms.
   2. Pre-wet soil and sand subgrades and surfaces of precast concrete to receive fresh concrete.
   3. Position and secure expansion joint materials, anchors, waterstops, screeds, control joint forms, and expansion caps on slip-dowels.
   4. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment, formwork and reinforcing.

B. Prepare and have ready in good working condition chutes, tremies, pumps, buggies, vibrators and other equipment necessary for orderly and continuous concrete placement.

C. Inspect and repair vapor retarder where applicable.

3.02 INSTALLATION

A. Conveying:
   1. Prevent separation, segregation and loss of ingredients.
   2. Convey concrete from mixer to place of final deposit as rapidly as possible.
   3. Take special precautions with belt conveyors to prevent segregation of ingredients, drying and rise in temperature during conveying.
   4. Use pumps or pneumatic equipment with adequate pumping capacity. Do not exceed 2 inches of slump loss due to pumping. Do not convey concrete through pipes made of aluminum or aluminum alloy.
   5. Thoroughly clean conveying equipment at end of each placement sequence.

B. Depositing:
   1. Place concrete continuously in horizontal layers not more than 12 inches deep. Exercise care to avoid seams or weakened planes within concrete. Deposit concrete into, not away from, previously deposited concrete.
   2. Do not place fresh concrete against concrete that would result in cold joints.
   3. Do not place concrete which has partially set or that contains foreign material.
   4. Avoid splashing forms and reinforcing with concrete.
   5. Place concrete in forms as near as practicable to final position. Do not transport concrete in forms with vibrators or screeds.
   6. Do not drop concrete directly into standing water. Use a tremie with outlet near bottom of place of deposit.
   7. Use tremies, chutes or hoppers to place concrete where a vertical drop greater than 5 feet is required.
   8. Do not place concrete when slump tests indicate plasticity greater than required limits.
   9. Indiscriminate addition of water to increase slump is prohibited. When concrete arrives at jobsite with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded.

C. Consolidating:
   1. Conform to ACI 309
   2. As soon as concrete is deposited, thoroughly agitate by means of mechanical vibrators and suitable hand tools, to work mixture well into parts and corners of forms, and entirely around reinforcement and inserts.
   3. Use mechanical vibrators with minimum frequency of 7000 revolutions per minute.
   4. Do not over-vibrate concrete or use vibrators to transport concrete within forms. Insert vibrators vertically at frequent intervals, do not drag vibrators through concrete.
   5. Do not insert vibrators into lower courses that have begun to set.
   6. Maintain spare vibrators on job site during concrete placing operations.

D. Placement against hardened concrete:
   1. Remove laitance and thoroughly clean and dampen surface of hardened concrete before placement of fresh concrete.
   2. If bond is required, roughen surface in an acceptable manner that exposes coarse aggregate and does not leave laitance, loose aggregate particles, or damaged concrete at surface.
   3.

3.03 APPLICATION

A. Construction Joints
   1. Each unit of structure (beam, column, pier, footing, joist, slab or wall) to be monolithic in construction except where specifically required to be otherwise.

2. Where required, locate construction joints within middle third of span of conventionally reinforced beams, joists, and slabs. Coordinate construction joint locations in post-tensioned beams, joists, and slabs with post-tensioning supplier.
3. Locate construction joints only where shown in structural Contract Documents or approved submittals.

B. Weather Conditions:
1. Cold Weather:
   a. Conform to ACI 306 when air temperature has fallen, or is expected to fall, below 40 degrees Fahrenheit within 3 days of concrete placement.
   b. Concrete mixture temperature can be adjusted by adding uniformly heated water and/or aggregates that conform to ACI requirements.
   c. Maintain temperature of deposited concrete between 50 degrees Fahrenheit and 70 degrees Fahrenheit for a minimum of 7 days after placement.
   d. Clear surfaces to receive concrete and spaces to be filled with concrete of snow, ice, and standing water before placement.
   e. Discuss cold weather concreting methods with Architect prior to concrete placement.
2. Hot Weather:
   a. Conform to ACI 305, when ambient temperature is 80 degrees Fahrenheit or higher.
   b. Maximum allowable fresh concrete temperature is 95 degrees Fahrenheit, unless one of the following has been submitted to and approved by Architect:
      1) Letter written by concrete supplier guaranteeing performance of a higher fresh concrete temperature based on past field experience with similar production conditions, materials, constituent proportions and temperatures, and delivery times.
      2) Preconstruction testing of concrete mixture at higher fresh concrete temperature in accordance with ACI 305.1 satisfies project requirements for fresh concrete properties and specified strength.
   c. Concrete mixture temperature can be adjusted by adding chilled water, substituting portions of mixing water with chipped or shaved ice, or other methods that conform to ACI requirements.
   d. Control concrete surface bleed-water evaporation with application of evaporation reducers, plastic sheeting, fog spray, or wind breaks.
   e. Discuss hot weather concreting methods with Architect prior to concrete placement.

C. Composite Concrete/Steel Construction
1. Do not place concrete until inspection and measuring requirements of structural steel, composite metal floor deck and field welded shear studs are complete.
2. Where concrete is to be placed on unshored steel beams, take care to prevent excessive deflection of beams during construction.
3. For beam spans greater than 40 feet, place concrete from center of beams, working towards both ends simultaneously.
4. Screed concrete slabs placed on unshored steel beams to required slab thickness above metal deck. Do not level.

D. Slab Thickness
1. Allowable deviation from cross sectional dimensions
   a. Suspended slabs: minus ¼ inch
   b. Slabs on ground:
      1) Average of samples: minus 3/8 inch
      2) Individual sample: minus ¾ inch

E. Slab Flatness and Levelness:
1. General: Gap under straightedge and between support points of a freestanding 10 foot straightedge conform to the following requirements:
   a. For slabs on grade and level suspended slabs shored until after testing: plus or minus 1/4 inch in 10 feet in any direction, maximum 1 inch variation between

columns, but not to exceed F_L and F_F limits below. Laser leveling of floor slab surface permitted.

b. For unshored suspended slabs: plus or minus 1/4 inch in 10 feet in any direction, but not to exceed F_F limits below. See Division 5 Sections for steel frame tolerances. Laser leveling of floor slab surface not permitted.

2. Definitions:
   a. F_F - maximum variation in floor elevation within any 2-foot length; "flatness"
   b. F_L - maximum variation in floor elevation between any 2 points separated by 10 feet; "levelness"
   c. Specified Overall Value - minimum average for Project
   d. Minimum Local Value - minimum within each column bay
3. Slab flatness and levelness measurements:
   a. Measure where requested by Owner or Architect, at Owner's expense.
   b. Measure in accordance with ASTM E1155 and ACI 117.
   c. Required minimum flatness and levelness values:
      1) Typical Slab
         a) Slab-on-Grade
            I) Specified Overall Value – F_F 25 / F_L 20
            II) Minimum Local Value – F_F 17 / F_L 15
         b) Level Suspended Slabs Shored Until After Testing
            I) Specified Overall Value – F_F 25 / F_L 20
            II) Minimum Local Value – F_F 17 / F_L 15
         c) Unshored Suspended Slabs
            I) Specified Overall Value – F_F 25
            II) Minimum Local Value – F_F 17

3.04 FINISHING EXPOSED CONCRETE SURFACES

A. General
   1. Conform to ACI 302.1.
   2. Double screed slabs at required elevations.
   3. Provide camber as required.
   4. Apply finishing products and cure in accordance with manufacturers' recommendations.

B. Slab Surfaces
   1. Scratch Finish
      a. Locations
         1) Surfaces receiving topping slabs
         2) Final finish where topping slabs, waterproofing membrane or roofing is placed over finished surface.
      b. Method: Place, consolidate, strike off, and level concrete. Cut high spots and fill low spots. Roughen surface with stiff brushes or rakes before concrete becomes too stiff to brush or rake.
   2. Float finish
      a. Locations -Walks, steps, and surfaces receiving waterproofing, roofing, insulation, or sand-bed terrazzo.
      b. Method – Place, consolidate, strike off, and level concrete. Cut high spots and fill low spots. Do not perform further finishing operations until concrete is ready for floating. Floating with hand float, bladed power float equipped with float shoes, or powered disk float. Begin floating when bleed water sheen has disappeared and surface has stiffened sufficiently to permit operation of selected float apparatus. Unless otherwise specified, produce finish that will meet tolerance requirements of ACI 117 for conventional surfaces.
   3. Trowel Finish
      a. Locations – Interior floors.

b. Method: Float then trowel concrete surface. Unless otherwise specified, conform to tolerances for a flat surface in accordance with ACI 117. Addition of water to surface to facilitate finishing is prohibited. Do not apply hard-troweled finish to concrete with total air content greater than 3 percent.

4. Broom or belt finish:
   a. Locations: For parking slabs and exterior surfaces including slabs, ramps, walkways, and steps.
   b. Method: After concrete has received float finish, give concrete surface a coarse-scored texture by drawing a broom or burlap belt across surface.
   c. Provide mockup of concrete finish for Architect and Owner approval.

C. Saw-Cutting Concrete Slabs-on-Grade
1. Saw joints as soon as possible after finishing, but only after concrete is hard enough. Concrete is hard enough when saw blade does not dislodge aggregate and when edges of sawcut do not ravel.
2. Provide joints a minimum of 1/4 inch wide and 1/4 of slab thickness deep unless noted otherwise in Contract Documents.
3. Formed strips may be used in lieu of saw-cutting in same locations and to equal depth as sawn joints.

D. Formed Surfaces
1. General: Solidly fill holes resulting from removal of bolts or tie rods with cement grout. Fill holes passing entirely through concrete members from inside face with a plunger-type grease gun or other device to force grout through to outside face.
2. Rough Form Finish
   a. Locations: For surfaces not exposed to view.
   b. Remove fins exceeding 1/4 inch in height, and grind bulges that interfere with other trades.
   c. Fill holes and honeycombs.
3. Smooth Form Finish
   a. Locations: For surfaces exposed to view.
   b. Remove fins, bulges and unsightly form marks.
   c. Fill holes and honeycombs to match surrounding concrete surfaces.
   d. Provide rubbed finish where satisfactory form finish cannot be achieved.
4. Rubbed Finish
   a. Locations: For surfaces exposed to view.
   b. Apply finish as soon as possible after casting concrete, no later than one day following form removal.
   c. Wet surface and rub with carborundum brick or other abrasive to produce uniform color and texture.
   d. Patch and dress form tie holes and honeycombs to match color and texture of surrounding concrete.

3.05 CURING AND PROTECTION

A. Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical damage. Conform to ACI 308.

B. Protect surfaces not in contact with forms from moisture loss with one of the following methods immediately after finishing and continuing for a period of at least 7 days:
1. Ponding or continuous sprinkling
2. Application of absorptive mats or fabric kept continuously wet
3. Application of sand kept continuously wet
4. Continuous application of steam or mist
5. Application of waterproof sheet materials
6. Application of curing compound in conformance with ASTM C309. Apply curing compounds in accordance with manufacturer's recommendations.

a. Do not use curing compound on any surface against which additional concrete is to be placed or other material is to be bonded, unless it is proven that compound will not inhibit bonding, or positive measures are taken to completely remove compound from areas to received bonded materials.

C. Protect surfaces cast against forms from moisture loss by keeping forms wet until removed. After form removal, protect exposed surfaces from moisture loss by one of the methods specified for surfaces not in contact with forms

D. Continue curing for a period of 7 days for Type I cement, 3 days for Type III cement, or until tests indicate that concrete has attained 70 percent of required strength.

3.06 Waterstop Installation

A. Bulb Type Waterstop Installation
1. Heat fuse-welded field butt splices using a Teflon coated, thermostatically controlled waterstop welding iron at manufacturer's recommended temperature. Follow waterstop manufacturer recommendations. Do not lap waterstops, use adhesives with waterstops, or use solvents with waterstops.
2. Center waterstop in joint and secure waterstop in correct position using grommets, pre-punched holes, or hog rings spaced at 12 inches on center along length of waterstop and wire tie to adjacent reinforcing steel.

B. Adhered Waterstop Installation
1. Inspect waterstop for discontinuity and debris contamination prior to concrete placement. Replace unacceptable waterstop with new product.
2. Adhere waterstop to concrete using waterstop manufacturer's recommended adhesive in accordance with manufacturer's recommendations.
3. Allow adhesive to cure for 2 hours (or longer if recommended by manufacturer) prior to placing concrete over waterstop.
4. Apply waterstop on same day as primer adhesive, within recommended time after applying primer adhesive.
5. Splice waterstop by overlapping ends and pressing ends together in a molding action ensuring no separation or air pockets.
6. Remove separation paper from waterstop just prior to subsequent placement of concrete.

3.07 FIELD QUALITY CONTROL

A. Laboratory Testing and Inspection
1. Concrete Compression Testing: Secure composite samples in accordance with ASTM C172. Take samples for strength tests of each mix design placed each day at the following intervals:
   a. not less than once daily,
   b. nor less than once for each 150 cubic yards of concrete,
   c. nor less than once for each 5,000 square feet of surface area for slabs or walls.
2. Mold and cure specimens from each sample in accordance with ASTM C31. Test concrete specimens in accordance with ASTM C39. A single strength test consists of one of the following:
   a. Four 6 inch by 12 inch cylinders: one cylinder tested at 7 days, two cylinders tested at 28 days, one cylinder held in reserve if needed.
   b. Five 4 inch by 8 inch cylinders: one cylinder tested at 7 days, three cylinders tested at 28 days, one cylinder held in reserve if needed.
3. Determine slump for each strength test and whenever consistency of concrete appears to vary, in accordance with ASTM C143. Ready mix trucks with Verifi Slump Management System, or approved equal, are permitted.
4. Determine total air content of concrete sample for each strength test.
   a. Conform to ASTM C231 for normal weight concrete
   b. Conform to ASTM C138 or C173 for lightweight concrete.
5. Determine concrete temperature by ASTM C1064 for each strength test.

6. Inspection and Monitoring:
    a. Water additions during transit permitted in accordance with ASTM C94, with trucks equipped with automated slump and water management systems, such as Verifi Slump Management System.
    b. Monitor addition of water to concrete at job site and length of time concrete is allowed to remain in truck during pour.
    c. Certify each delivery ticket indicating class of concrete delivered or poured, amount of water added, time at which cement and aggregate were discharged into truck, and time at which concrete was discharged from truck.

B. Waterstop Field Quality Control
1. Bulb Type waterstop splices: the following PVC waterstop splicing defects are unacceptable and will be rejected:
    a. Tensile strength less than 80 percent of parent section
    b. Misalignment of centerbulb greater than 1/16 inch
    c. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness
    d. Misalignment that reduces waterstop cross section more than 15 percent
    e. Visible porosity in weld
    f. Bubbles or inadequate bonding
    g. Visible signs of splice separation when cooled splice is bent by hand at sharp angle
    h. Charred or burned material

C. Contractor's Responsibilities
1. Furnish necessary labor to assist testing agency in obtaining and handling samples at job-site.
2. Advise testing agency 24 hours in advance of operations to allow for assignment of testing personnel and testing.
3. Provide and maintain for use of testing agency adequate facilities for proper curing of concrete test specimens on project site in accordance with ASTM C31.
4. Burden of proof of structural adequacy where strength tests fail to meet criteria

D. Evaluation and Acceptance:
1. Strength test is defined as the average of one of the following, made from the same concrete sample tested at 28 days or as determined by Architect:
    a. Two 6 inch by 12 inch cylinders
    b. Three 4 inch by 8 inch cylinders
2. Strength level of a given class of concrete will be considered satisfactory if each of the following requirements are met for that class of concrete:
    a. Average of any three consecutive strength test results equals or exceeds specified strength.
    b. No strength test result falls below specified strength by more than 500 psi when specified strength is 5,000 psi or less, or by more than 10 percent of specified strength when specified strength is greater than 5,000 psi.
3. Concrete strength tests made and tested by testing laboratory are sole criteria of concrete strength unless in-situ tests are made in accordance with Building Code by a qualified independent testing laboratory. Concrete for which strength tests do not meet criteria for acceptance is considered inadequate until proven otherwise.
4. Where strength tests fail to meet criteria specified herein:
    a. Architect is sole judge of structural adequacy of concrete
    b. Additional strength evaluations of hardened concrete:
        1) Architect may request core testing in conformance with ACI 301 at no additional cost to Owner
        2) Nondestructive testing is not acceptable for determining in-place strength.
    c. If Architect determines, based on strength evaluation testing, that structure is of inadequate strength: repair or remove and replace portions of structure in question, as directed by Architect, at no additional expense to Owner.

d. If strength tests fall below specified strength, but not so low as to cause concern for structural adequacy, Architect may request improved conditions of curing or modification of design mixes to improve strength.

3.08 CLEANING AND REPAIR

A. Upon completion of work, perform the following cleaning and repair procedure:
   1. Remove forms, equipment, protective coverings and resulting rubbish from premises.
   2. Sweep with ordinary broom and remove mortar, concrete droppings, loose dirt, and mud.
   3. Wash concrete floors and platforms with soapsuds and scrub with steel fiber brush.
   4. Mop up suds and flush surfaces with clean water.
      a. Provide adequate measures during scrubbing, mopping, and flushing operations to keep excessive or injurious amounts of water off floors.
   5. Promptly, effectively and satisfactorily repair any damage occasioned to such floors by or on account of such operations.
   6. Leave finished concrete surfaces in clean condition.

B. Remove concrete not required by Contract Documents caused by overpour, bulging or collapse of forms or error in form construction.

END OF SECTION

SECTION 03 5416

HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F (10 and 27 deg C).

PART 2 - PRODUCTS

2.1 HYDRAULIC CEMENT UNDERLAYMENTS

A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch (6 mm) and that can be feathered at edges to match adjacent floor elevations.
1. Products Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. ARDEX; K-15 Self-Leveling Underlayment Concrete.
b. Dayton Superior Corporation; LeveLayer.
c. MAPEI Corporation; Ultraplan Easy.
d. Maxxon Corporation; Level-Right.
e. Specialty Construction Brands, Inc.; an H.B. Fuller company; TEC Smooth Start.

B. Cement Binder: ASTM C 150/C 150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.

C. Compressive Strength: Not less than 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.

D. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm); or coarse sand as recommended by underlayment manufacturer.
1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

E. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).

F. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
1. VOC Content: Provide coating with VOC content of 100 g/L or less.

G. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.
   1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
   2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
   1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m) in 24 hours.
      b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, or as recommended by hydraulic cement underlayment manufacturer.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.
   1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
   2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
   3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply underlayment to produce uniform, level surface.
   1. Apply a final layer without aggregate to product surface.
   2. Feather edges to match adjacent floor elevations.

C. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

D. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

E. Apply surface sealer at rate recommended by manufacturer.

F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION

SECTION 04 0110

MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning the following:
   1. Unit masonry surfaces.

1.2 ALLOWANCES

A. Allowances for cleaning masonry are specified in Section 01 2100 "Allowances."

1.3 DEFINITIONS

A. Very Low-Pressure Spray: Under 100 psi (690 kPa).

B. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

C. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

D. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to cleaning masonry including, but not limited to, the following:
      a. Verify masonry-cleaning equipment and facilities needed to make progress and avoid delays.
      b. Materials, material application, and sequencing.
      c. Cleaning program.
      d. Coordination with building occupants.

1.5 SEQUENCING AND SCHEDULING

A. Work Sequence: Perform masonry-cleaning work in the following sequence:
   1. Remove plant growth.
   2. Inspect for open mortar joints. Where repairs are required, delay further cleaning work until after repairs are completed, cured, and dried to prevent the intrusion of water and other cleaning materials into the wall.
   3. Remove paint.
   4. Clean masonry surfaces.
   5. Where water repellents are to be used on or near masonry, delay application of these chemicals until after cleaning.

B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units according to masonry repair Sections. Patch holes in mortar joints according to masonry repointing Sections.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include material descriptions and application instructions.
   2. Include test data substantiating that products comply with requirements.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For paint-remover manufacturer and chemical-cleaner manufacturer.

B. Preconstruction Test Reports: For cleaning materials and methods.

C. Cleaning program.

1.8 QUALITY ASSURANCE

A. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.

B. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used; protection of surrounding materials; and control of runoff during operations. Include provisions for supervising worker performance and preventing damage.
   1. If materials and methods other than those indicated are proposed for any phase of cleaning work, add a written description of such materials and methods, including evidence of successful use on comparable projects and demonstrations to show their effectiveness for this Project.

C. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Cleaning: Clean an area approximately 25 sq. ft. (2.3 sq. m) for each type of masonry and surface condition.
      a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
      b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage one or more chemical-cleaner manufacturers to perform preconstruction testing on masonry surfaces.
   1. Use test areas as indicated and representative of proposed materials and existing construction.
   2. Propose changes to materials and methods to suit Project.

1.10 FIELD CONDITIONS

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

B. Clean masonry surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least seven days after completion of cleaning.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.

D. Mold, Mildew, and Algae Remover, Job-Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.

E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.

F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

G. Acceptable Cleaning Solution Manufacturers:
   1. Prosoco.

2.2 ACCESSORY MATERIALS

A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.

2.3 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

PART 3 - EXECUTION

3.1 PROTECTION

A. Remove gutters and downspouts and associated hardware adjacent to immediate work area and store during masonry cleaning. Reinstall when masonry cleaning is complete.
   1. Provide temporary rain drainage during work to direct water away from building.

3.2 CLEANING MASONRY, GENERAL

A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.

B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

C. Use only those cleaning methods indicated for each masonry material and location.
   1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
   2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.
      a. Equip units with pressure gages.
      b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
      c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
      d. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
      e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
      f. For steam application, use steam generator capable of delivering live steam at nozzle.

D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.

E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.

F. Water Application Methods:
   1. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
   2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

G. Steam Cleaning: Apply steam to masonry surfaces at the very low pressures indicated for each type of masonry. Hold nozzle at least 6 inches (150 mm) from masonry surface and apply steam in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

H. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

I. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
   1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

J. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.3 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, calking, asphalt, and tar.
   1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
   2. Remove paint and calking with alkaline paint remover.
      a. Comply with requirements in "Paint Removal" Article.
      b. Repeat application up to two times if needed.
   3. Remove asphalt and tar with solvent-type paste paint remover.
      a. Comply with requirements in "Paint Removal" Article.
      b. Apply paint remover only to asphalt and tar by brush without prewetting.
      c. Allow paint remover to remain on surface for 10 to 30 minutes.
      d. Repeat application if needed.

3.4 CLEANING MASONRY

A. Cold-Water Wash: Use cold water applied by medium -pressure spray.

B. Hot-Water Wash: Use hot water applied by medium -pressure spray.

C. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi (207 kPa). Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.

D. Detergent Cleaning:
   1. Wet surface with cold or hot water applied by low-pressure spray.
   2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
   3. Rinse with cold or hot water applied by high-pressure spray to remove detergent solution and soil.
   4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

E. Mold, Mildew, and Algae Removal:
   1. Wet surface with hot water applied by low-pressure spray.
   2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
   3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
   4. Rinse with cold or hot water applied by medium -pressure spray to remove mold, mildew, and algae remover and soil.
   5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

F. Nonacidic Gel Chemical Cleaning:
1. Wet surface with cold or hot water applied by low-pressure spray.
2. Apply gel cleaner in 1/8-inch (3 mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Remove bulk of gel cleaner.
5. Rinse with hot water applied by medium -pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

G. Nonacidic Liquid Chemical Cleaning:
1. Wet surface with hot water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with hot water applied by medium -pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage chemical-cleaner manufacturer's factory-authorized service representatives for consultation and Project-site inspection, to perform preconstruction product testing, and provide on-site assistance when requested by Architect. Have chemical-cleaner manufacturer's factory-authorized service representatives visit Project site not less than twice to observing progress and quality of the work.

3.6 FINAL CLEANING

A. Clean adjacent nonmasonry surfaces of spillage and debris. Use detergent and soft brushes or cloths.

B. Remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

C. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION

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SECTION 04 2000

UNIT MASONRY

PART 1 - GENERAL

A. Section Includes:
1. Concrete masonry units.
2. Clay face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:
1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
a. Show locations of control joints including additional proposed locations that may not be indicated on the Drawings.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:
1. Exposed CMUs.
2. Clay face brick, in the form of straps of five or more bricks.
3. Special brick shapes.
4. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:
1. Masonry units.
a. Include data on material properties.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.
2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

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.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
a. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
1) ACM Chemistries, Inc.; RainBloc.
2) BASF Corporation; MasterPel 240.
3) Euclid Chemical Company (The), an RPM International company; EUCON BLOCKTITE.
4) GCP Applied Technologies Inc.; DRY-BLOCK Block Admixture.
5) Moxie International; Moxie Shield 1800 Admixture

C. CMUs: ASTM C90.
1. Density Classification: Lightweight.
2. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.4 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216.
1. Grade: SW.
2. Type: FBS.
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C67.
4. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."

5. Application: Use where brick is exposed unless otherwise indicated.
6. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
7. Size, Color, and Texture: As scheduled.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91/C 91M.
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. Cemex S.A.B. de C.V.
b. Essroc.
c. Holcim (US) Inc.
d. Lafarge North America Inc.
e. Lehigh Hanson; Heidelberg Cement Group.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
a. Davis Colors; True Tone Mortar Colors.
b. Euclid Chemical Company (The); an RPM company.
c. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
d. Solomon Colors, Inc; Solomon Colors Mortar Colors.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
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) Essroc.
2) Holcim (US) Inc.
3) Lafarge North America Inc.
4) Lehigh Hanson; Heidelberg Cement Group.
2. Colored Masonry Cement:
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) Cemex S.A.B. de C.V.
2) Essroc.
3) Holcim (US) Inc.
4) Lafarge North America Inc.
5) Lehigh Hanson; Heidelberg Cement Group.
3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments shall not exceed 10 percent of portland cement by weight.
5. Pigments shall not exceed 5 percent of masonry cement by weight.

G. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4-inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.

H. Aggregate for Grout: ASTM C404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
      a. BASF Aktiengesellschaft; MasterSet FP 20.
      b. Euclid Chemical Company (The); an RPM International company; ACCELGUARD 80.
      c. GCP Applied Technologies Inc., MORSET.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
   a. ACM Chemistries, Inc.; RainBloc for Mortar.
   b. BASF Aktiengesellschaft; MasterPel 235.
   c. Euclid Chemical Company (The); an RPM International company; BLOCKTITE MORTAR ADMIXTURE.
   d. GCP Applied Technologies Inc.; DRY-BLOCK Mortar Admixture.

K. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77 mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   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. Dur-O-Wal; a Hohmann & Barnard company.
      b. Heckmann Building Products, Inc.
      c. Hohmann & Barnard, Inc.
      d. Lock Rite.
      e. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
   1. Interior Walls: Hot-dip galvanized carbon steel.
   2. Exterior Walls: Stainless steel.
   3. Wire Size for Side Rods: 0.148-inch (3.77 mm) diameter.
   4. Wire Size for Cross Rods: 0.148-inch (3.77 mm) diameter.
   5. Wire Size for Veneer Ties: 0.148-inch (3.77 mm) diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
   7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:
   1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches (100 mm) wide, plus two side rods at each wythe of masonry 4 inches (100 mm) wide or less.

2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16 mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
   2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
   3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Corrugated-Metal Ties: Not allowed.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
   1. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
   2. Wire: Fabricate from 3/16-inch- (4.76 mm-) diameter, hot-dip galvanized steel wire.

E. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf (445-N) load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch (1.5 mm).
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- (2.66 mm-) thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- (4.76 mm-) diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a gasketed sheet metal anchor section, 1-1/4 inches (32 mm) wide by 6 inches (152 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (152 mm) long, stamped into center to provide a slot between strap and base for inserting wire tie. Self-adhering, modified bituminous gasket fits behind anchor plate and extends beyond pronged legs. Where continuous insulation is shown, provide anchor portion with tabs to prevent crushing of insulation when installed.
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) Hohmann & Barnard, Inc.
2) Wire-Bond.
5. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83 mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours according to ASTM B117.

2.9 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:
1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).
a. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
1) Carlisle Coatings & Waterproofing Inc.; CCW-705-TWF Thru-Wall Flashing.
2) GCP Applied Technologies Inc.; Perm-A-Barrier Wall Flashing.
3) Heckmann Building Products, Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
4) Hohmann & Barnard, Inc.; TeXtroflash.
5) Polyguard Products, Inc.; Polyguard 400.
6) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

C. Termination Bars for Flexible Flashing: Stainless steel bars 0.075 inch by 1 inch (1.90 mm by 25 mm).

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane , or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:
   1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
      a. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
         1) Heckmann Building Products, Inc.; No. 85 Cell Vent.
         2) Hohmann & Barnard, Inc.; QV Quadro-Vent.
         3) Wire-Bond; #3601 Cell Vent
         4) Mortar Net Solutions; CellVent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
      a. Heckmann Building Products, Inc.; #84 WallDefender.
      b. Hohmann & Barnard, Inc.; Mortar Trap.
      c. Mortar Net Solutions; MortarNet.
      d. Wire-Bond; Cavity Net DT (3611D).
   2. Configuration: Provide one of the following:
      a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   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. Diedrich Technologies, Inc., a Hohmann & Barnard company.
      b. EaCo Chem, Inc.
      c. PROSOCO, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   1. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
   2. For exterior masonry, use portland cement-lime or masonry cement mortar.
   3. For reinforced masonry, use portland cement-lime or masonry cement mortar.
   4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type S.
   3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
   4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Pigments shall not exceed 5 percent of masonry cement by weight.
   3. Mix to match Architect's sample.

4. Application: Use pigmented mortar for exposed mortar joints with the following units:
   a. Clay face brick.

E. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12 mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12 mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch (100 mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 8443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:
1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Cut joints flush where indicated to receive air barriers unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, with not less than one anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

B. Provide not less than 2 inches (50 mm) of airspace between back of masonry veneer and face of insulation.
1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick as follows:
1. Build in compressible joint fillers where indicated.

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 9200 "Joint Sealants," but not less than 3/8 inch (10 mm).
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under water-resistive barrier, lapping at least 4 inches (100 mm). Fasten upper edge of flexible flashing to sheathing through termination bar.
   3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
   4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
   1. Use specified weep/cavity vent products to form weep holes.
   2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

F. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.
   1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors for structural masonry to perform tests and inspections and prepare reports. All other tests and inspections will be performed by Contractor. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Steel columns
2. Steel beams
3. Steel trusses
4. Fusion welded anchors
5. Miscellaneous angles and plates
6. Manufactured Bearing Assemblies
7. Bolts
8. Steel assemblies to be embedded in concrete
9. Laboratory testing and inspection
10. Shop painting
11. Supplementary parts and members necessary to complete and erect structural steel frame

1.02 REFERENCE STANDARDS (Latest Edition)

A. American Institute of Steel Construction, AISC:
1. AISC Manual of Steel Construction.
2. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
3. Code of Standard Practice for Steel Buildings and Bridges.
4. Specification for Structural Joints Using ASTM A325 or A490 Bolts.

B. American Society for Testing and Materials:
1. ASTM A36, Standard Specification for Structural Steel.
2. ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A108, Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
4. ASTM A123, Standard Specification for Zinc (Hot- Galvanizing) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, bars and strip.
5. ASTM A143, Recommended Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
6. ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
8. ASTM A307, Standard Specification for Carbon Steel Externally Threaded Standard Fasteners.
9. ASTM A325, Standard Specification for High-Strength Bolts for Structural Steel Joints.
10. ASTM A449, Standard Specification for Quenched and Tempered Steel Bolts and Studs.
11. ASTM A490, Standard Specification for Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
12. ASTM A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.
15. ASTM A786, Standard Specification for Hot-Rolled Carbon, Low Alloy, High Strength Low Alloy, and Alloy Steel Floor Plates
16. ASTM A992, Standard Specification for Steel for Structural Shapes for Use in Building Framing.

17. ASTM F1554, Standard Specification for Anchor Bolts
18. ASTM B117, Standard Salt Spray (Fog) Testing.
19. ASTM D522, Standard Test for Elongation of Attached Organic Coatings with Conical Mandrel Apparatus.

C. American Welding Society:
1. AWS D1.1, Structural Welding Code - Steel.
2. AWS D1.3, Structural Welding Code - Sheet Steel.

D. Industrial Fasteners Institute:
1. Handbook on Bolt, Nut and Rivet Standards.

E. American National Standards Institute:
1. ANSI B18.2, Fasteners.
2. ANSI B27.2, Plain Washers.

F. The Society for Protective Coatings, SSPC:
1. SSPC Painting Manual, Volume 1, Good Painting Practice.
2. SSPC Painting Manual, Volume 2, Systems and Specifications.

1.03 SUBMITTALS

A. Shop Drawings: Submit detailed shop and installation drawings showing shop and erection details including member sizes, grades of materials, details of fabrication and erection, and end connections.
1. Do not begin fabrication of materials prior to review of shop drawings.
2. Review of shop drawings is for member sizes, spacings, detail, and general compliance with Contract Documents only.
3. Material quantities, lengths, fit, verification of job conditions and coordination with other trades are responsibility of Contractor.
4. Calculations: Submit calculations for connections as required, signed and sealed by a Professional Engineer experienced in such design and registered in the State of the Project.
5. Reproductions of Contract Drawings shall not be used for shop drawings.

B. Erection Procedure: Submit descriptive data illustrating general procedure for erection of structural steel including sequence of work, proposed schedule and details of temporary staying and bracing.

C. Submit Mill Certifications showing compliance of materials with ASTM and AISC Specifications.

D. Submit Mill Certifications (Manufacturer's Inspection Certificates) for bolts, nuts and washers.

E. Submit manufacturer’s data sheets or certified test results indicating compliance with requirements for manufactured components.

F. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:
1. Product Disclosure:
a. If available, provide a product specific Type III, third party certified, Environmental Product Declaration (EPD) for each product in which the product manufacturer is explicitly recognized as a participant by the program operator.
b. If available, provide a third party verified Corporate Sustainability Report (CSR) for each product that covers at least 90 percent of the product contents.
c. If available, provide a published Health Product Declaration (HPD) for each product documenting the role, amount, and health hazards for every ingredient of the product.
2. Recycled Content:
a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
b. Indicate material cost of product less labor included in project.

c. If recycled content is part of an assembly, indicate the percentage of pre-consumer and post-consumer recycled contents in the assembly by weight.

3. Local / Regional Materials:
   a. Indicate location of extraction, manufacture, and purchase of all products; indicate distance between the points of extraction, manufacture, and purchase and the project site.
   b. Indicate the material cost less labor of all products extracted, manufactured, and purchased within a 100 mile radius of the project site.

1.04 QUALIFICATIONS

A. Arc-Welding: Welding procedures and techniques, welders and tackers shall be qualified in accordance with AWS D1.1.
   1. Welders to be employed on Work shall maintain current AWS certification throughout duration of Project.
   2. If requested by Architect, submit identifying stenciled test coupons made by operator whose workmanship is subject to question, and if reasonable doubt of proficiency exists, welder shall be re-qualified and certified by independent testing laboratory at no additional expense to Owner.
   3. Work suspected of deficient quality may be subject to removal of coupons from any location on any joint for testing. Remove sections of welds found defective and properly rewelded before proceeding with work.

B. Steel Fabricator: not less than 5 years of experience in fabrication of structural steel.

C. Steel Erector: not less than 5 years of experience in erection of structural steel.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of anchor bolts and other anchorage assemblies to be embedded in concrete or masonry construction. Provide setting drawings, instructions and templates required for proper placement of anchor bolts and embeds.

B. Sequence shipments of fabricated steel to expedite erection and minimize field handling of material.

C. Store structural steel above ground on skids or platforms, and protect from corrosion. Store packaged materials in unbroken containers.

D. Do not bend or damage materials during shipment, handling and erection.

E. Take precautions in the removal of packaging or bundling devices to prevent damage to materials.

F. Certification numbers for fasteners shall appear on product containers and shall correspond to identification numbers on mill test reports.

PART 2 PRODUCTS

2.01 MATERIALS

A. Structural Steel, normal grade: ASTM A36.

B. High Strength Structural Steel: ASTM A572 - Grade 50.

C. High Strength Structural Steel (W-Sections): ASTM A992 – Grade 50.

D. Steel Pipes: ASTM A53 - Grade B (35,000 psi yield).

E. Hollow Structural Sections (HSS) – Round or Rectangular: ASTM A500 - Grade B.

F. Erection Bolts: ASTM A307, ANSI B18.2.1, and ANSI B18.2.2.

G. High Strength Bolts: ASTM A325N, ANSI B18.2.1, ANSI B18.2.2.
   1. Manufacturer's symbol and grade markings shall appear on bolts and nuts.

H. High Strength Bolts: ASTM A490N.
   1. Manufacturer's symbol and grade markings shall appear on bolts and nuts.

I. Anchor Bolts: ASTM F1554 Grade 36

J. High Strength Anchor Bolts: ASTM F1554 Grade 105.

K. Washers: ANSI B27.2 Type A.

L. Welding Electrodes:
   1. Welding electrodes shall conform to AISC Specifications. Use E70 electrodes for ASTM A36 and ASTM A572 Grade 50 Steel. Use E8018 for ASTM A441 steel.
   2. Coatings of low-hydrogen electrodes shall be thoroughly dry when used. Electrodes taken from hermetically sealed packages shall be used within 4 hours, or shall be dried in accordance with AWS D1.1 before use.
   3. Do not use electrodes of any type that have been wet.

M. Coatings for structural steel
   1. Shop Primer:
      a. Rust-inhibiting primer
      b. Paint and methods of paint application shall comply with applicable air-quality and environmental regulations.
      c. Paint shall be compatible with welding procedures and shall produce no significant difference in strength of weld material.
      d. Paint shall meet or exceed requirements for abrasion - Fed. Test No. 141; elongation - ASTM D522; and salt spray - ASTM B117.
   2. Primer for Architecturally Exposed Structural Steel
      a. Acceptable Products:
         1) Tnemec 10-09
         2) Valspar 13-R-29
         3) Carboline Phenoline 818
         4) Sherwin-Williams Kem Kromik Universal B50 Series
   3. Paint for steel exposed in the crawl space shall be equal to Tnemec 10-09 Alkyd Rust-Inhibitive Primer.
   4. Zinc-Coating: Where galvanizing steel is required, zinc coating shall conform to ASTM A123 and A143. Zinc coating for threaded products shall conform to ASTM A153. Do not galvanize ASTM A490 bolts.
   5. Cold Galvanizing: Galvilite as manufactured by ZRC WORLDWIDE, Marshfield, MA (phone 800.831.3275; web site www.zrcworldwide.com), and used for repair only.

N. Shear Studs
   1. Headed fusion welded shear connectors with proper ferrules and accessories especially designed to create composite deck action by mating of shear connectors, concrete deck, and supporting beam.
   2. Steel shall conform to ASTM A108 grades C1010-1020, minimum tensile strength of 60,000 psi.
   3. Studs shall be of uniform diameter, heads concentric and normal to shaft, and weld end chamfered and solid flux.

O. Slide Bearings:
   1. Pre-bonded, teflon-coated steel plates with initial static coefficient of friction not exceeding 0.06 at interface.
   2. Acceptable Products:
      a. Fluorogold Bearings, Seismic Energy Bearing Corp.
      b. Con-Slide Slide Bearings, Con-Serv Inc.
      c. Structural Expansion Bearings, Fabreeka International

2.02 PRODUCT DOCUMENTATION

A. In coordination with Project sustainability goals, provide products with third-party certified Type III Environmental Product Declarations (EPDs) in accordance with ISO 14025 that document the product’s environmental impacts associated with material extraction, energy use, chemical makeup, waste generation, and emissions.

B. In coordination with Project sustainability goals, provide products with third-party verified corporate sustainability reports (CSRs) that document material supply chains and extraction operations.

C. In coordination with Project sustainability goals, provide products with published Health Product Declarations (HPDs) that document the chemical inventory of the product to at least 0.1%.

2.03 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. In coordination with Project sustainability goals, provide products with environmental impacts below the industry average in the following categories:
   1. Global warming potential
   2. Depletion of the stratospheric ozone layer
   3. Acidification of land and water sources
   4. Eutrophication
   5. Formation of tropospheric ozone
   6. Depletion of nonrenewable resources

B. In coordination with Project sustainability goals, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 25% of the total value of the materials in the project.

C. In coordination with Project sustainability goals, ensure that products are sourced from manufacturers with third-party validated health, safety, and risk program.

D. In coordination with Project sustainability goals, provide products and materials that promote good indoor environmental quality (EQ) and promote efficiencies in operational performance.

E. In coordination with Project sustainability goals, provide materials and products that are sourced within 100 miles of the project site.

2.04 DESIGN OF CONNECTIONS

A. Design connections to resist required forces, where not detailed on Drawings.

B. Design connections for simple beams (except where end reactions are otherwise scheduled) for 55 percent of total uniform load capacity shown in Maximum Total Uniform Load Tables, Part 3, of AISC Manual, for given beam, span and grade of steel specified.

C. Note slip critical connection requirements clearly on shop drawings.

D. Complete penetration butt weld moment connections to develop 100% of flexural capacity of member.

E. Except as specifically noted otherwise, detail bolted connections using bolts conforming to ASTM A325N, Bearing Type Connections with threads allowed in shear plane. Details shall be in accordance with AISC Specification for Structural Joints.

F. Except as specifically noted otherwise, detail bolted connections using bolts conforming to ASTM A490, Bearing Type Connections with threads allowed in shear plane. Details shall be in accordance with AISC Specification for Structural Joints.

G. Design welded truss connections for 1.15 times required forces.

H. Diagonal Bracing: Where forces are indicated on the drawings, design connections for 1.15 times the indicated force. Where forces are not indicated, design connections for full strength of member in tension.

I. Do not use welds in combination with bolts in the same face of any connection.

2.05 FABRICATION

A. Fabricate materials in accordance with applicable AISC Specifications and Standards.

B. Pre-assemble work as much as possible and deliver to site ready for erection. Mark and match-mark pieces where field assembly is required.

C. Prior to fabrication; straighten materials, remove twists and bends and clean faying surfaces of scale and rust.

D. Clean members to be painted with power tools in accordance with SSPC standards.

E. Camber beams to within 1/8th inch per 15 feet of beam length. Mark beams indicating direction of fabricated or natural camber.

F. Provide members of required sizes, weights, shapes and lengths. Do not splice members to achieve required lengths except where specifically allowed by the Architect. Do not alter member shapes or lengths or enlarge bolt holes in the field for proper fit; return materials to the fabrication shop for correction where required. Member splices allowed for the convenience of the fabricator or erector shall not result in additional cost to the Owner.

G. Punch or drill holes for bolts. Hole sizes shall conform to AISC Specifications.

H. Compression joints shall have both contact surfaces milled for precision fit. Other joints shall be cut or dressed straight and true, and prepared as required for welding. Components of assemblies and built-up members shall be pinned and rigidly maintained in accurate position during final assembly.

2.06 WELDED CONSTRUCTION

A. Comply with AWS D1.1.

B. Clean surfaces of loose scale, rust, paint, grease and dirt. Remove oil with benzine. Wire brush welds after depositing for visual inspection. Welds shall be smooth and uniform in cross section, shall be free of porosity and clinkers, and shall have required fusion and penetration into base metal.

C. Secure members in proper position for welding.

D. Take proper precautions to minimize residual stresses and distortions in members being welded.

E. Preheat and interpass temperatures shall conform to Table 3.2, AWS D1.1.

F. Prepare members to be butt-welded in accordance with AISC recommendations for pre-qualified welds, and provide required clearances and back-up bars. Remove back-up bars after completing welds.

G. Lay fillet welds of required sizes in proper position and with gaps not exceeding AISC recommendations.

H. Tack welding shall not affect quality of finished welds.

2.07 BOLTED CONSTRUCTION

A. Provide holes at right angles to members of sizes recommended by AISC Specifications. Short-slotted holes shall not be used for primary frame connections (members connecting to columns), trusses and wind bracing unless specifically allowed by the Architect. Where used, short-slotted holes shall be oriented normal to the direction of load.

B. Provide beveled washers for surfaces out of parallel more than 1:20.

C. Provide bolts of sufficient length to extend entirely through nuts.

D. Protect fasteners from dirt and moisture at job site. Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protective storage. Fasteners not used shall be returned to protected storage at end of shift. Fasteners shall not be cleaned of lubricant that is present in as-delivered condition. Fasteners for slip critical connections which must be cleaned of accumulated rust or dirt resulting from job site conditions, shall be cleaned and relubricated prior to installation.

E. Anchor bolts and erection bolts: tighten with a suitable wrench not less than 15 inches long. Tap bolt heads with a hammer while tightening.

F. High Strength Bolts (typical, except as noted otherwise): install bolts in properly aligned holes, and tighten to snug tight condition. Snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact.

G. High Strength Bolts (Slip-Critical Connections): Install bolts in properly aligned holes, tightened in accordance with Section 8 of AISC Specifications for Structural Joints. Use either calibrated wrench or turn-of-the-nut method. Provide hardened washers when calibrated wrench method is to be used.

H. Hand tighten and tack weld (nut-to-bolt shank) bolts required to be "finger-tight".

I. Holes for anchor bolts in base plates may be oversized in accordance with AISC Specifications. Provide washers as indicated on Drawings.

2.08 COATINGS

A. SHOP PAINTING
1. Apply one coat of rust-inhibitive primer to surfaces of structural steel members except: surfaces required to be field welded, to be encased in concrete, to be spray fireproofed, and top flanges of beams with shear connectors to support metal deck.
2. Thoroughly clean surfaces to be painted of all loose mill scale, dirt, rust, and other foreign matter with steel scrapers, wire brushes, or sandblasting in accordance with SSPC SP-3. Remove oil and grease with solvents.
3. Mix paint in accordance with manufacturer's recommendations, continuously stir during application, and do not add thinner after initial mixing.
4. Apply paint in accordance with manufacturer's recommendations, thoroughly work over surfaces and into corners. Minimum dry thickness of coating shall be 2 mils.
5. Repair damage to coating prior to delivery.

B. GALVANIZING
1. Galvanize exposed steel members supporting cooling tower and other members as noted on Drawings.
2. Shelf angles supporting masonry or stone shall be galvanized.

2.09 PRODUCTS

A. FUSION WELDED ANCHORS
1. Comply with AWS D1.1, Section 7.
2. Clean surfaces to be welded of rust, oil, grease, paint and dirt. Remove mill scale by scraping or sandblasting.
3. Weld headed studs with appropriate equipment properly adjusted for climactic conditions.
4. Remove ceramic ferrules after welding.

B. POT BEARING ASSEMBLIES
1. Provide pot bearings of the types (fixed, unidirectional, multi-directional), and of the load capacity and movement range(s) required.
2. Pot bearings shall be manufactured of high strength steel (ASTM A-588), and the pot shall be milled from an integral piece of steel (welding of the ring and base plate will not be accepted).
3. The sliding surface of the top plate shall be polished stainless steel (ASTM A240) with a 10 micron RMS finish.
4. The sliding element shall be Teflon, resistant to acids, alkalis and petroleum products, and shall be stable to 500 degrees Fahrenheit and impermeable to water.
5. Neoprene bearing pads shall conform to AASHTO M251 (50 Durometer hardness).
6. Sealing rings shall be made from ASTM B-36, Alloy 260, halfhard brass, cold rolled and open-ended.
7. Steel surfaces exposed to weather shall be metalized to AWS C-2.2
8. Manufacturers:
   a. D.S. Brown Company, North Baltimore, Ohio

2.10 RE-USE OF EXISTING MATERIALS

A. Materials removed from existing construction may be re-used in the work provided that such materials conform in all respects to the requirements for new materials. Members larger than required shall not be used without approval of the Architect.

B. Deliver materials to the fabrication shop, and fabricate in accordance with the requirements for new members.

C. Members damaged or bent in removal shall not be used.

2.11 SOURCE QUALITY CONTROL

A. Testing of Shear Studs:
   1. When temperature is below 32 degrees F, one stud in each 100 shall be tested.
   2. Minimum of 2 shear studs shall be tested at start of each production period in order to determine proper generator, control unit and stud welder setting. Studs shall be capable of being bent 45 degrees from vertical without weld failure. If, after welding, visual inspection reveals that sound weld or full 360 degree fillet has not been obtained for a particular stud, stud shall be struck with hammer and bent 15 degrees off perpendicular toward nearest end of beam. Studs failing this test shall be replaced.

B. Pre-Erection Testing of High Strength Bolts
   1. Test at least three bolt, nut and washer assemblies from each lot of bolts supplied to job site.
   2. Test assemblies in a tension measuring device at site to verify that assemblies can develop tension listed in Table 4 of AISC Specification for Structural Joints.
   3. Bolt tension shall be developed by tightening of nut.

C. Inspection of Structural Steel:
   1. Provide access to materials in fabrication and full cooperation to testing laboratory.
   2. Following testing services shall be performed:
      a. Inspect fabrications in shop.
      b. Check temporary bracing of steel frame.
      c. Check location and condition of anchor bolts.
      d. Check plumbness and tolerance of steel frame.
      e. Qualification of welders and welding techniques.
      f. Visually inspect erection bolts.
      g. Inspection of high-strength bolting:
         1) In accordance with Section 9 of AISC Specifications for Structural Joints.
         2) Confirm that fasteners meet project specification and are properly stored and handled.
         3) Confirm that faying surfaces have been properly prepared before connections are assembled.
         4) Observe testing and calibration and confirm that procedures used result in the required fastener tension.
         5) Visually inspect connections.
         6) Check tightness of at least 33% of slip-critical connections.
         7) Check tightness of at least 2 bolts of each slip-critical girder to column connection.
      h. Visually inspect all field and shop welds.
      i. Complete-penetration welds.
         1) Ultrasonic or X-ray testing per AWS Standards.
         2) Testing shall be performed on 100% of shop and field complete-penetration welds.
      j. Re-inspect corrective measures required at expense of Contractor.

D. Remove and replace Connections found to be faulty at no additional cost to the contract.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify condition and position of anchor bolts and embeds in concrete prior to commencing erection.

B. Correct misaligned or missing components required for connections to steel framework before commencing erection.

C. Measure camber of erected steel beams and report deviations from required camber before placing concrete slabs. Do not place concrete on beams that have inadequate or negative camber.

3.02 ERECTION AND FIELD ASSEMBLY

A. Erect structural steel in accordance with AISC Specifications. Work shall be plumb, square, true to line, level and in proper position and orientation.

B. Provide temporary bracing and guys to maintain stability of framework during erection for stresses and loads due to erection equipment and its operation, weight of structure, wind, and temporary loads imposed during erection. Check and adjust bracing frequently during progress of erection and assembly. Maintain temporary bracing until all components of the structure required for lateral stability are in place and final connections made.

C. Do not stack materials on partially completed framework, or in a manner to cause damage or overloading of the structure.

D. Tolerances shall be in accordance with AISC Code of Standard Practice and as follows:
1. Displacement of columns adjacent to elevator shafts not to exceed 1 inch at any point.
2. Individual members plumb or level to within 1:750.
3. Vertical dimensions: 1/4 inch per story, exclusive of elastic shortening of columns.
4. Floor framing members: +-1/4 inch from column splice next above.
5. Horizontal dimensions: +- 1:2000 for overall length or width.

E. Field Assembly:
1. Assemble steel framework accurately to lines and elevations indicated and within specified tolerances. Align and adjust members forming parts of a completed frame before fastening.
2. Erect structural steel in proper sequence with work of other trades.
3. Tie anchor bolts securely in position before concrete is placed.
4. Thoroughly clean bearing surfaces and surfaces to be in permanent contact before assembly.
5. Adjust bolt holes requiring enlargement only by reaming, not by drifting or burning.
6. Erection bolts may be tightened and left in place, except in architecturally exposed work. Fill holes left from removed bolts by plug welding. Grind welds smooth where architecturally exposed.
7. Straighten and correct members damaged during handling, or replace without additional cost to the Owner.
8. Install slide bearing assemblies in accordance with manufacturer's instructions.
9. Where shoring of beams and girders is required, provide positive support at midpoint of spans under 25 feet and at third points of spans over 25 feet. Locate temporary supports directly above beams at the supporting floor, or transfer load to beams with load spreaders. Re-shore where construction loading exceeds live load capacity of supporting floor.

F. Field Connections:
1. After frame is aligned and plumb, make final welded and bolted connections in accordance with AISC Specifications.
2. Properly sequence welding to prevent distortion, and misalignment of the framework.
3. Maintain temporary bracing of the structure until connections are complete and other required components of the structure (e.g. floor slabs and metal roof decks) are in place.

3.03 ADJUSTING

A. Touch-up field welds, abrasions and scarred areas of structural steel with same paint used for shop coating after erection of frame and final connections are completed.

3.04 INSTALLATION OF PRODUCTS

A. POT BEARING ASSEMBLIES
   1. Preparation - surfaces to receive pot bearing assemblies shall be smooth, even and horizontal.
      a. Concrete surfaces must be dense and uniform and without cracks.
   2. Pot bearings may be temporarily shimmed with timber packing to be removed during the grouting operation or may be set on a full-bed steel leveling plate.
      a. Steel shims or blocks shall not be used.
      b. Leveling nuts shall not be used directly under bearing assemblies.

3.05 FIELD PAINTING

A. Refer to Section 09 90 00 for field painting of exposed steel.

END OF SECTION

SECTION 05 1213

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Architecturally exposed structural steel (AESS).
   2. Section 05 1200 "Structural Steel Framing" requirements that also apply to AESS.

B. Related Requirements:
   1. Section 05 5000 "Metal Fabrications" for miscellaneous steel fabrications not defined as structural steel.
   2. Section 09 9600 "High-Performance Coatings" for surface preparation and priming requirements.

1.2 DEFINITIONS

A. AESS: Architecturally exposed structural steel.

B. Category AESS 1: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 1 and may be designated AESS 1 or Category AESS 1 in the Contract Documents.

C. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and is designated as AESS 2 or Category AESS 2 in the Contract Documents.

D. Category AESS 3: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 3 and is designated as AESS 3 or Category AESS 3in the Contract Documents.

E. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.

F. Category AESS C: Structural steel with custom characteristics that is categorized by ANSI/AISC 303, Section 10, as AESS C and is designated as AESS C or Category AESS C in the Contract Documents.

G. SEAC/RMSCA Guide Specification: SEAC/RMSCA's "Sample Specification, Section 05 0213: Architecturally Exposed Structural Steel."

1.3 COORDINATION

A. Coordinate surface preparation requirements for shop-primed items.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:
   1. Tension-control, high-strength, bolt-nut-washer assemblies.
   2. Corrosion-resisting (weathering steel), tension-control, high-strength, bolt-nut-washer assemblies.
   3. Filler.
   4. Primer.
   5. Galvanized-steel primer.
   6. Etching cleaner.
   7. Galvanized repair paint.

B. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS.
   1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
   2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   3. Include embedment Drawings.
   4. Indicate orientation of mill marks and HSS seams.
   5. 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. Indicate grinding, finish, and profile of welds.
   6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.

7. Indicate exposed surfaces and edges and surface preparation being used.
8. Indicate special tolerances and erection requirements.
9. Indicate weep holes for HSS and vent holes for galvanized HSS.
10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.

C. Samples: Submit Samples to set quality standards for AESS.
1. Two steel plates, 3/8 by 8 by 4 inches (9.5 by 200 by 100 mm), with long edges joined by a groove weld and with weld ground smooth.
2. Steel plate, 3/8 by 8 by 8 inches (9.5 by 200 by 200 mm), with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches (100 by 150 by 9.5 mm), welded to plate with a continuous fillet weld and with weld ground smooth and blended.
3. Round steel tube or pipe, minimum 8 inches (200 mm) in diameter, with end of another round steel tube or pipe, approximately 4 inches (100 mm) in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.

1.6 INFORMATIONAL SUBMITTALS
A. Qualification Data: For fabricator.
B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.7 QUALITY ASSURANCE
A. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P2 or SSPC-QP 3.
B. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
1. Build mockup of typical portion of AESS as shown on Drawings.
2. Coordinate high-performance coatings requirements with Section 09 9600 "High-Performance Coatings."
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.9 FIELD CONDITIONS
A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

2.2 BOLTS, CONNECTORS, AND ANCHORS
A. Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round-head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, (ASTMA563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
1. Finish: Plain.

2.3 FILLER
A. Polyester filler intended for use in repairing dents in automobile bodies.

2.4 PRIMER
A. Steel Primer:
1. Comply with Section 09 9600 "High-Performance Coatings."

B. Galvanized-Steel Primer:.
1. Comply with Section 09 9600 "High-Performance Coatings."

2.5 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.

B. Category AESS 3:
1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.
6. Limit butt and plug weld projections to 1/16 inch (1.6 mm).
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.
17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
19. Orient HSS seams as indicated or away from view.
20. Align and match abutting member cross sections.
21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch (3.2 mm). At closed joints, maintain uniform contact within 1/16 inch (1.6 mm).
22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.

C. Erection marks, painted marks, and other marks are permitted on galvanized- steel surfaces of completed structure.

D. Cleaning Corrosion-Resisting (Weathering) AESS: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6 (WAB)/NACE WAB-3.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
3. Galvanize AESS lintels attached to structural-steel frame and located in exterior walls.

2.8 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Corrosion-resisting (weathering) steel surfaces.
   5. Galvanized surfaces unless indicated to be painted.

B. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 6 (WAB)/NACE WAB-3.

C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner or according to SSPC-SP 16.

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and eased edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
   1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
   2. Grind tack welds smooth.
   3. Remove backing and runoff tabs, and grind welds smooth.
   4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
   5. Remove erection bolts in AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
   6. Fill weld access holes in AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
   7. Conceal fabrication and erection markings from view in the completed structure.

B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
   1. Erection of Category AESS 3:
      a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
      b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
      c. Remove weld spatter, slivers, and similar surface discontinuities.
      d. Grind off butt and plug weld projections larger than 1/16 inch (1.6 mm).
      e. Continuous welds shall be of uniform size and profile.

f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
g. Splice members only where indicated on Drawings.
h. No torch cutting or field fabrication is permitted.
i. Weld profiles, quality, and finish shall be as approved by Architect.
j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to inspect AESS as specified in Section 05 1200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 PROTECTION

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.

B. Touchup Priming: Cleaning and touchup priming are specified in Section 09 9600 "High-Performance Coatings."

TABLE 10.1
AESS Category Matrix

Category		AESS C	AESS 4	AESS 3	AESS 2	AESS 1	SSS
Id	Characteristics	Custom Elements	Showcase Elements	Feature Elements in close view	Feature Elements not in close view	Basic Elements	Standard Structural Steel
1.1	Surface preparation to SSPC-SP 6		•	•	•	•	
1.2	Sharp edges ground smooth		•	•	•	•	
1.3	Continuous weld apprearance		•	•	•	•	
1.4	Standard structural bolts		•	•	•	•	
1.5	Weld spatters removed		•	•	•	•	
2.1	Visual samples		•	•	optional		
2.2	One-half standard fabrication tolerances		•	•	•		
2.3	Fabrication marks not apparent		•	•	•		
2.4	Welds uniform and smooth		•	•	•		
3.1	Mill marks removed		•	•			
3.2	Butt and plug welds ground smooth and filled		•	•			
3.3	HSS weld seam oriented for reduced visibility		•	•			
3.4	Cross sectional abutting surface aligned		•	•			
3.5	Joint gap tolerances minimized		•	•			
3.6	All welded connections		optional	optional			
4.1	HSS seam not apparent		•				
4.2	Welds contoured and blended		•				
4.3	Surfaces filed and sanded		•				
4.4	Weld show-through minimized		•				

User Note:

1.1 Prior to blast cleaning, grease and oil are removed by solvent cleaning to meet SSPC-SP1.
1.2 Rough surfaces are deburred and ground smooth. Sharp edges resulting from flame cutting, grinding and especially shearing are softened.
1.3 Intermittent welds are made continuous, either with additional welding, caulking or body filler. For corrosive enviroments, all joints are seal welded. Seams of hollow structural sections are acceptable as produced.
1.4 All bolt heads in connections are on the same side, as specified, and consistent from one connection to another.
1.5 Weld spatter, slivers, surface discontinuities are removed. Weld projection up to $^1/_{16}$ in. (2 mm) is acceptable for butt and plug welded joints.

2.1 Visual samples are either a 3-D rendering, a physical sample, a first-off inspection, a scaled mock-up or a full-scale mock-up, as specifed in the *contract documents*.
2.2 These tolerances are one-half of those for standard structural steel as specified in this Code.
2.3 Members markings during the fabrication and erection processes are not visible.

3.1 All mill marks are not visible in the finished product.
3.2 Caulking or body filler is acceptable.
3.3 Seams are oriented away from view or as indicated in the *contract documents*.
3.4 The matching of abutting cross sections is required.
3.5 This characteristic is similar to 2.2 above. A clear distance between abutting members of $^1/_8$ in. (3 mm) is required.
3.6 Hidden bolts may be considered.

4.1 HSS seams are treated so they are not apparent.
4.2 The steel surface imperfections are filled and sanded.
4.3 Weld show-through on the back side of a welded element can be minimized by hand grinding the back side surface. The degree of weld-through is a function of weld size and material.

C. Additional characteristics may be added for custom elements.

END OF SECTION

SECTION 05 4000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Review methods and procedures related to cold-formed metal framing installation, including those contained in metal framing engineer's delegated design submittal.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Indicate exterior sheathing screw fastener spacing to be utilized at interior zones and corner zones of building façade, as required to ensure sheathing installation will withstand negative wind pressures imposed by design wind speeds.

C. Delegated Design: Provide shop drawings signed and sealed by a structural engineer licensed to practice in the location of the project, indicating ability of system and attachment to supporting construction to resist indicated or code required loads.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Manufacturer Qualifications: Member in good standing of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.
   1. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.

E. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.

F. Comply with AISI S100, and AISI S200 and ASTM C955, Section 8.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI's "Code of Standard Practice."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CEMCO.
   2. ClarkDietrich.
   3. MarinoWARE.
   4. SCAFCO Steel Stud Company.
   5. Steel Network, Inc. (The).

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design cold-formed steel framing including fasteners and connections to building structure.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated on Drawings.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing behind Brick or Stone Masonry Veneer: Horizontal deflection of 1/600 of the wall height.
      b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
   3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 3/4 inch (19 mm) unless noted otherwise.
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
   1. Wall Studs: AISI S211.
   2. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Framing Members, General: Comply with AISI S200 and ASTM C955, Section 8 for conditions indicated.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90).

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60 (Z180).

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: As required by structural performance.
   2. Flange Width:2 inches (51 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: As required by structural performance.
   2. Flange Width: 1-1/4 inches (32 mm).

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ClarkDietrich.
      b. MarinoWARE.
      c. Steel Network, Inc. (The).

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: As required by structural performance.
      b. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: As required by structural performance.
      b. Flange Width: As required by structural performance.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
   2. Flange Width: As required by structural performance.
   3. Section Properties: As required by design.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: As required by structural performance but no less than 0.0329 inch (0.84 mm).
   2. Flange Width: As required by structural performance.

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AllSteel & Gypsum Products, Inc.
      b. ClarkDietrich.
      c. MarinoWARE.
      d. SCAFCO Steel Stud Company.
      e. Simpson Strong-Tie Co., Inc.
      f. Steel Network, Inc. (The).
      g. Steeler, Inc.

D. Single Deflection Track: Not permitted.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: As required by structural performance, but no less than 0.0329 inch (0.84 mm).
      b. Flange Width: As required by Structural performance.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: As required by structural performance, but no less than0.0329 inch (0.84 mm).
      b. Flange Width: As required by Structural performance.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers and knee braces.
   9. Hole-reinforcing plates.
   10. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554,Grade 55, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by mechanically deposition according to ASTM B 695, Class 50.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01as appropriate for the substrate.
   1. Uses: Securing cold-formed steel framing to structure.
   2. Type: Torque-controlled expansion anchor.
   3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint:MIL-P-21035B or SSPC-Paint 20.

B. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
   4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing 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 PREPARATION

A. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 07 2100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install double deep-leg deflection tracks and anchor outer track to building structure.
2. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated on Drawings.
2. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install double deep-leg deflection tracks and anchor outer track to building structure.
2. Connect vertical deflection clips to studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 FIELD QUALITY CONTROL

A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Shelf angles.
6. Miscellaneous steel trim.
7. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for all items listed in summary above:
1. Include shop drawings and structural analysis data signed and sealed by the qualified professional engineer licensed to practice in the location of the project, demonstrating the design and connections will meet all indicated and code required loads.

C. Delegated Design: Provide shop drawings signed and sealed by a structural engineer licensed to practice in the location of the project, indicating ability of system and attachment to supporting construction to resist indicated or code required loads.

D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

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 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 2 (A4).

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

F. Post-Installed Anchors: Torque-controlled expansion anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Division 09 Section(s) on Painting

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. 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 (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Weld shelf angle to embed plate where indicated.

D. Galvanize and prime shelf angles located in exterior walls.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

C. Prime plates with zinc-rich primer.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

2.11 BRAKE METAL

A. Material: Galvanized steel formed in press brake.

B. Thickness: As indicated.

C. Finish: Field Painted.

D. Texture: Smooth.

E. Profile: As indicated.

2.12 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 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.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."

END OF SECTION

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SECTION 05 5213

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel pipe and tube railings.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. 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.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated Design: Provide shop drawings signed and sealed by a structural engineer licensed to practice in the location of the project, indicating ability of system and attachment to supporting construction to resist indicated or code required loads.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
      b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
   1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 FASTENERS

A. General: Provide the following:
   1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
   2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
   2. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1)stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
   1. Water-Resistant Product: where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   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 flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form Changes in Direction as Follows:
   1. As detailed.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:
1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion where painted railings are indicated.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

C. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

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SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood furring.
4. Plywood backing panels.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

1.3 ACTION SUBMITTALS

A. 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. 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.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood.
2. Fire-retardant-treated wood.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Furring.
   5. Other concealed locations.

B. Miscellaneous Lumber Items: Construction or No. 2grade lumber of any species.
   1. Mixed southern pine or southern pine; SPIB.
   2. Spruce-pine-fir; NLGA.
   3. Western woods; WCLIB or WWPA.
   4. Northern species; NLGA.
   5. Eastern softwoods; NeLMA.

C. 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.

D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.
1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
   2. ICC-ES evaluation report for fastener.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 1600

SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Wall sheathing.
2. Parapet sheathing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. 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 plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. CertainTeed Corporation; GlasRoc.
b. Continental Building Products, LLC; Weather Defense.
c. Georgia-Pacific Building Products; DensGlass Sheathing.
d. National Gypsum Company; Gold Bond eXP Sheathing.
e. United States Gypsum Company; Securock.
2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 120 inches (1219 by 3048 mm) for vertical installation.
4. Mold Growth: 10 when tested according to ASTM D3273.
5. Permeance: 22 perms.
6. Combustibility: Noncombustible.
7. Coating: If required by roofing system manufacturer for adhering membrane to sheathing, provide factory applied coating to sheathing to enhance adhesion.

2.3 PARAPET SHEATHING

A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, Exterior, Structural I sheathing.
1. Span Rating: Not less than 20/0.
2. Nominal Thickness: Not less than 3/4 inch.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
2. For parapet and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
   1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
   2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

END OF SECTION

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SECTION 064116

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plastic-laminate-clad architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. The Work of this Section is affected by Section 01 2300 “Alternates”.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 "Door Hardware" to manufacturer of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

C. Samples for Verification: For the following:
1. Plastic Laminates: 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish required.
a. Provide one sample applied to core material with specified edge material applied to one edge.
2. Thermoset Decorative Panels: 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish.
a. Provide edge banding on one edge.
3. Corner Pieces:
a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
b. Miter joints for standing trim.
4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of product.
1. Composite wood and agrifiber products.
2. Thermoset decorative panels.
3. High-pressure decorative laminate.
4. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 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 between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.

B. 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.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. 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.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.
   2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless and with face frame.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality 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. Formica Corporation.
      b. Wilsonart.

F. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade VGS.
   4. Edges: Grade HGS.
   5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
      a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
      b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
      c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
   2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
   3. Drawer Bottoms: Thermoset decorative panels.

H. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. Match Architect's sample.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
   2. Particleboard: ANSI A208.1, Grade M-2.
   3. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal, 5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.

E. Catches: Magnetic catches, BHMA A156.9, B03141 .

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Shelf Rests: BHMA A156.9, B04013; metal.

H. Drawer Slides: BHMA A156.9.
   1. Grade 1 and Grade 2: Side mounted.
      a. Type: Full extension with overtravel.
      b. Material: Epoxy-coated steel with polymer rollers.
   2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full -extension type; zinc-plated-steel ball-bearing slides.
   3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.

4. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.
6. For computer keyboard shelves, provide Grade 1HD-100.
7. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-200.

I. Door Locks: BHMA A156.11, E07121.

J. Drawer Locks: BHMA A156.11, E07041.

K. Door and Drawer Silencers: BHMA A156.16, L03011.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 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 or adhesive specified above for faces.

D. Decorative Resin Panels: Provide resin panels at reception desk as indicated on Drawings.
1. Basis-of-Design Product: 3Form; Varia.
2. Color and Finish: As scheduled.

2.5 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. 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.

C. 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
   1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   2. Install cabinets without distortion so doors and drawers fit openings 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.
   3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c..

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

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SECTION 06 4219

PLASTIC-LAMINATE-FACED WOOD PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plastic-laminate-faced wood paneling.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced wood paneling that is not concealed within other construction.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For plastic-laminate-faced wood paneling.
1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer

B. Product Certificates: For each type of product.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products .

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups of typical paneling as shown on Drawings.
2. 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. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where paneling is 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.
   1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PANELING FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
   1. Brochsteins, Inc.
   2. Robert Shaw Mfg. Co., Inc.
   3. Environment Limited.
   4. CRC Mastercraft, LLC, Khoury.
   5. Soelberg Industries.

B. Basis-of-Design Products:
   1. Soelberg Industries; Piastra.
      a. Core Thickness: 3/4 inch.
   2. Soelberg Industries; Flauto
      a. Core Thickness: 1-1/4 inches.

2.2 PANELING, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood paneling (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.
   1. Provide inspections including installation together with labels from AWI certification program indicating that woodwork complies with requirements of grades specified.
   2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.3 PLASTIC-LAMINATE-FACED WOOD PANELING

A. Grade: Custom.

B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
   1. Faces: Grade HGS.
   2. Backs: Grade BKV.
   3. Exposed Edges: Same as faces or Grade VGS.

C. Colors, Patterns, Sizes, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
   1. As selected by Architect from laminate manufacturer's full range.

D. Panel Core: MDF.

E. Exposed Panel Edges: Plastic-laminate matching faces.

F. Adhesives for Bonding Plastic Laminate: Unpigmented contact cement.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

G. Assemble panels by gluing and concealed fastening.

2.4 MATERIALS

A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

B. Wood Moisture Content:8 to 13 percent.

C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

2.5 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.6 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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.

2.7 FABRICATION

A. Complete fabrication, including assembly, 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.
   1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.

B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition paneling to humidity conditions in installation areas.

B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.

B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.

C. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless covered by trim.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.

B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

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SECTION 06 4219.13

RACQUETBALL COURT PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. High-impact plastic-laminate-faced wood ceiling paneling for racquetball court.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced wood paneling that is not concealed within other construction.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For plastic-laminate-faced wood paneling.
1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer

B. Product Certificates: For each type of product.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products .
1. All work in conjunction with the racquetball and/or squash court walls and ceilings as indicated on the drawings and as specified herein shall be installed by one specialty contractor approved by the manufacturer.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups of typical paneling as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Panel tolerances for racquetball court panels shall comply with tolerances as published by United States Racquetball Association (USRA).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where paneling is 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.
   1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 WARRANTY

A. Panel materials shall be warranted by the manufacturer for a period of ten years from date of installation against defects and delamination when installed in accordance with manufacturers specifications.

PART 2 - PRODUCTS

2.1 PANELING, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood paneling (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.
   1. Provide inspections including installation together with labels from AWI certification program indicating that woodwork complies with requirements of grades specified.
   2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Steel Framing:
   1. Ceilings: 6 inches by 16 gauge steel galvanized joists 16 inches O.C. attached a 1/4 points to exterior building wall or mezzanine deck support.

2.2 PLASTIC-LAMINATE-FACED WOOD PANELING

A. Basis-of-Design Products: Allied Products, LLC; Court Panel System.

B. Panels:
   1. Racquetball Courts:
      a. Ceiling: 9/16 inch thick.

C. Dimensions:
   1. Panels shall be 4′ x 8′ and 4′ x 4′ installed in a staggered configuration.

D. Surface:
   1. High-pressure plastic laminate with velvet texture finish (.050) thick with an average density of 85 lbs./cf.

E. Core:
   1. Industrial grade high-density particleboard of nominal 55 lbs./cf and 45 lbs./cf density conforming to commercial standards.

F. Colors, Patterns, Sizes, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
   1. As selected by Architect from laminate manufacturer's full range.

G. Panel Core: MDF.

H. Exposed Panel Edges: Plastic-laminate matching faces.

I. Adhesives for Bonding Plastic Laminate: Unpigmented contact cement.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

J. Assemble panels by gluing and concealed fastening.

2.3 MATERIALS

A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

B. Wood Moisture Content:8 to 13 percent.

C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.5 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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.

2.6 FABRICATION

A. Complete fabrication, including assembly, 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.
   1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.

B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition paneling to humidity conditions in installation areas.

B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.

B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.

C. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless covered by trim.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.

B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 06 4600

WOOD TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior standing and running trim.
   2. Shop priming of wood trim.
   3. Shop finishing of wood trim.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.

C. Samples for Verification:
   1. Lumber and panel products with shop-applied opaque finish, 5 inches (125 mm) wide by 12 inches (300 mm) long for lumber and 8 by 10 inches (200 by 250 mm) for panels, for each finish system and color, with one-half of exposed surface finished.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of product.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups of typical wood trim as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim 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.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
1. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Custom.

B. Wood Species: Any closed-grain hardwood.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.
2. Wood Moisture Content for Interior Materials: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

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. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.6 FABRICATION

A. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
1. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
2. Edges of Rails and Similar Members More Than 3/4 inch (19 mm) Thick: 1/8 inch (3 mm).

B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

C. Assemble casings in shop except where shipping limitations require field assembly.

D. Assemble moldings in shop to maximum extent possible. Miter corners in shop and prepare for field assembly with bolted fittings designed to pull connections together.

2.7 SHOP PRIMING

A. Interior Wood Trim for Transparent Finish: Shop seal with stain (if required), other required pretreatments, and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

2.8 SHOP FINISHING

A. General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Section 099123 "Interior Painting" and Section 099300 "Staining and Transparent Finishing" for field finishing wood trim not indicated to be shop finished.

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.
1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to end-grain surfaces.

D. Transparent Finish for Interior Trim:
1. Grade: Same as item to be finished.
2. Finish: System - 3, postcatalyzed lacquer.
3. Finish: System - 12, water-based polyurethane.
4. Staining: Match approved sample for color.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.

E. Opaque Finish for Interior Trim:
1. Grade: Same as item to be finished.
2. Finish: System - 12, water-based polyurethane.
3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Flat, 15-30 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor wood trim 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. For shop-finished items, use filler matching finish of items being installed.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
2. Install wall railings on indicated metal brackets securely fastened to wall framing.

G. Touch up finishing work specified in this Section after installation of wood trim. Fill nail holes with matching filler where exposed.
1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

H. Refer to Section 099123 "Interior Painting" and Section 099300 "Staining and Transparent Finishing" for final finishing of installed wood trim not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.

B. Clean wood trim on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 06 6400

PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.
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. Crane Composites, Inc
b. Glasteel.
c. Marlite.
d. Newcourt, Inc.
e. Nudo Products, Inc.
f. Parkland Plastics, Inc.
2. Basis-of-Design Product: Crane Composites, Inc; Sequentia Wall Panels.
3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.
4. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
5. Surface Finish: Molded pebble texture.
6. Color: Match existing.

2.3 FACTORY-LAMINATED PLASTIC SHEET PANELING

2.4 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
1. Color: Match panels.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Sealant: Mildew-resistant, single-component, neutral-curing silicone**----** sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates 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 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
   1. Mark plumb lines on substrate at panel joint locations for accurate installation.
   2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
   1. Drill oversized fastener holes in panels and center fasteners in holes.
   2. Apply sealant to fastener holes before installing fasteners.

D. Install factory-laminated panels using concealed mounting splines in panel joints.

E. Install trim accessories with adhesive. Do not fasten through panels.

F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 07 0150.19

PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Full tear-off of entire roof system.
2. Removal of flashings and counterflashings.
3. Temporary roofing.

1.2 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner’s property, demolished materials shall become Contractor’s property and shall be removed from Project site.

1.3 DEFINITIONS

A. EPS: Molded (expanded) polystyrene.

B. Full Roof Tear-off: Removal of existing roofing system down to existing roof deck.

C. OSB: Oriented strand board.

D. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:
a. Reroofing preparation, including roofing system manufacturer's written instructions.
b. Temporary protection requirements for existing roofing system components that are to remain.
c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
e. Existing roof deck conditions requiring Architect notification.
f. Existing roof deck removal procedures and Owner notifications.
g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
h. Structural loading limitations of roof deck during reroofing.
i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
j. HVAC shutdown and sealing of air intakes.
k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
l. Governing regulations and requirements for insurance and certificates if applicable.
m. Existing conditions that may require Architect notification before proceeding.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Temporary Roofing Submittal: Product data and description of temporary roofing system.
1. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer stating acceptance of the temporary roof and that its inclusion does not adversely affect the new roofing system's resistance to fire and wind, specified special warranty, or its FM Approvals rating.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
   1. Include certificate that Installer is approved by warrantor of existing roofing system.

B. Photographs: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations.
   1. Submit before Work begins.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Approved by warrantor of existing roofing system to work on existing roofing.

B. Regulatory Requirements:
   1. Comply with governing EPA notification regulations before beginning roofing removal.
   2. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.8 FIELD CONDITIONS

A. Existing Roofing System: SBS-modified bituminous roofing.

B. Owner will not occupy portions of building immediately below reroofing area.
   1. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.
      a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.

C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
   1. A roof moisture survey of existing roofing system is available for Contractor's reference.
   2. The results of an analysis of test cores from existing roofing system are available for Contractor's reference.

F. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
   1. Remove only as much roofing in one day as can be made watertight in the same day.

G. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. Existing roof will be left no less watertight than before removal.
   3. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
      a. Hazardous materials will be removed by Owner under a separate contract.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

A. EPS Insulation: ASTM C 578.

B. Plywood: DOC PS 1, Grade CD, Exposure 1.

C. OSB: DOC PS 2, Exposure 1.

2.2 INFILL AND REPLACEMENT MATERIALS

A. Use infill materials matching existing roofing system materials unless otherwise indicated.
   1. Infill materials are specified in Section 075552.13 "Atactic-Polypropylene (APP) Modified Bituminous Protected Membrane Roofing" unless otherwise indicated.

B. Wood blocking, curbs, and nailers are specified in Section 061053 Miscellaneous Rough Carpentry."

C. Parapet Sheathing:
   1. Pressure-preservative -treated plywood wall sheathing, 3/4-inch thick, complying with Section 061600 "Sheathing."

D. Fasteners: Factory-coated steel fasteners with metal or plastic plates listed in FM Approvals' RoofNav, and acceptable to new roofing system manufacturer.

2.3 AUXILIARY REROOFING MATERIALS

A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:
   1. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
   2. Comply with requirements of existing roof system manufacturer's warranty requirements.

B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.

C. Shut off rooftop utilities and service piping before beginning the Work.

D. Test existing roof drains to verify that they are not blocked or restricted.
   1. Immediately notify Architect of any blockages or restrictions.

E. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.
   1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

F. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

G. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.
   1. Prevent debris from entering or blocking roof drains and conductors.
      a. Use roof-drain plugs specifically designed for this purpose.
      b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
   2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.
      a. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 ROOF TEAR-OFF

A. Notify Owner each day of extent of roof tear-off proposed for that day.

B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.

C. Full Roof Tear-off: Remove existing roofing and other roofing system components down to the existing roof deck.
   1. Remove roof insulation and cover board.
   2. Remove base flashings and counter flashings.
   3. Remove perimeter edge flashing and gravel stops.
   4. Remove copings.
   5. Remove expansion-joint covers.
   6. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
   7. Remove roof drains indicated on Drawings to be removed.
   8. Remove wood blocking, curbs, and nailers.
   9. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry.
      a. Remove unadhered bitumen, unadhered felts, and wet felts.
   10. Remove excess asphalt from steel deck.
      a. A maximum of 15 lb/100 sq. ft. (0.72 kg/sq. m) of asphalt is permitted to remain on steel decks.
   11. Remove fasteners from deck or cut fasteners off slightly above deck surface.

3.3 DECK PREPARATION

A. Inspect deck after tear-off of roofing system.

B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect.
1. Do not proceed with installation until directed by Architect.

C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.
1. Do not proceed with installation until directed by Architect.

D. Provide additional deck securement as indicated on Drawings.

E. Replace steel deck as indicated on Drawings.

F. Prepare and paint steel deck surface.
1. Painting and preparation for painting is specified in Section 099113 "Exterior Painting."

G. Replace plywood roof sheathing as directed by Architect.

3.4 INFILL MATERIALS INSTALLATION

A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.
1. Installation of infill materials is specified in Section 075552.13 "Atactic-Polypropylene (APP) Modified Bituminous Protected Membrane Roofing."
2. Installation of wood blocking, curbs, and nailers is specified in Section 061053 Miscellaneous Rough Carpentry."

B. Install new roofing patch over roof infill area.
1. If new roofing is installed the same day tear-off is made, roofing patch is not required.

3.5 TEMPORARY ROOFING

A. Install approved temporary roofing over area to be reroofed.

3.6 BASE FLASHING REMOVAL

A. Remove existing base flashings.
1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain.
1. Replace metal counterflashings damaged during removal with counterflashings specified in Section 076200 "Sheet Metal Flashing and Trim."

C. Remove existing parapet sheathing and replace with new parapet sheathing to comply with Section 061600 "Sheathing."
1. If parapet framing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

D. When directed by Architect, replace parapet framing, wood blocking, curbs, and nailers to comply with Section 061053 Miscellaneous Rough Carpentry."

3.7 FASTENER PULL-OUT TESTING

A. Perform fastener pull-out tests according to SPRI FX-1, and submit test report to roofing manufacturer before installing new roofing system.
1. Obtain roofing manufacturer's approval to proceed with specified fastening pattern.
a. Roofing manufacturer may furnish revised fastening pattern commensurate with pull-out test results.

3.8 DISPOSAL

A. Collect demolished materials and place in containers.
1. Promptly dispose of demolished materials.
2. Do not allow demolished materials to accumulate on-site.
3. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION

SECTION 07 2100

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass-fiber blanket.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Corporation; NoiseReducer Sound Attenuation and Acoustical Ceiling Batts.
b. Knauf Insulation; EcoBatt Unfaced with ECOSE Technology.
c. Owens Corning; EcoTouch PINK Fiberglas Insulation (unfaced).

2.2 ACCESSORIES

A. Insulation for Miscellaneous Voids:
1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

C. Hexagonal Wire Mesh:
1. Hot dip galvanized.
2. Wire Gage: 13 mm.
3. Aperture: 2-1/2 inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 2726

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vapor-permeable, fluid-applied air barriers.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.8 mm) over smooth, void-free substrates.
   1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
      a. DuPont Building Innovations: E. I. du Pont de Nemours and Company; Tyvek Fluid Applied WB+.
      b. GCP Applied Technologies Inc.; Perm-A-Barrier VPL 50 (VOC: 48 g/L)
      c. Henry Company; Air-Bloc 17.
      d. Hohmann & Barnard, Inc.; Enviro-Barrier VP (VOC: 0 g/L).
      e. Tremco Inc, an RPM International company; ExoAir 230 (VOC: 35 g/L).
   2. Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa)pressure difference; ASTM E 2178.
      b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m); ASTM E 96/E 96M, Water Method, Procedure B.
      c. Ultimate Elongation: Minimum 250percent; ASTM D 412, Die C.
      d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa)when tested according to ASTM D 4541.
      e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
      f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch (0.5 mm) thick, and Series 300 stainless-steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
   3. Verify that substrates are visibly dry and free of moisture.
   4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

G. Bridge expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
   3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.
   1. Transition Strip: Roll firmly to enhance adhesion.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
   1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Air-barrier dry film thickness.
   3. Continuous structural support of air-barrier system has been provided.
   4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   5. Site conditions for application temperature and dryness of substrates have been maintained.
   6. Maximum exposure time of materials to UV deterioration has not been exceeded.
   7. Surfaces have been primed, if applicable.
   8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   9. Strips and transition strips have been firmly adhered to substrate.
   10. Compatible materials have been used.
   11. Transitions at changes in direction and structural support at gaps have been provided.
   12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   13. All penetrations have been sealed.

C. Air barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

E. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.

2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

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SECTION 07 5552.13

ATACTIC-POLYPROPYLENE (APP) MODIFIED BITUMINOUS PROTECTED MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Atactic-polypropylene (APP)-modified bituminous protected membrane roofing.
2. Roof insulation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:
1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tie-in with adjoining air barrier.

C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates:
   1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
      a. Submit evidence of compliance with performance requirements.
   2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field Test Reports:
   1. Concrete internal relative humidity test reports.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer, stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. 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 special warranty.
   1. Installer shall employ on Project installers and supervisors certified through the NRCA/MRCA Certified Roofing Torch Applicator (CERTA) program.

1.8 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 manufacturer.
   1. Protect stored liquid material from direct sunlight.
   2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
   1. Store in a dry location.
   2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 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.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes roof membrane, base flashings, roof insulation, and other components of roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project 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 roof membrane, base flashing, roof insulation, for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and 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. Roof system and flashings shall remain watertight.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
   1. As indicated on Drawings.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency.
   1. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
   1. Identify products with appropriate markings of applicable testing agency.

2.2 MANUFACTURERS

A. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.3 BASE SHEET MATERIALS

A. APP-Modified Bitumen Polyester Mat Base Sheet: ASTM D 6222/D 6222M, Type I or II, Grade S, APP-modified asphalt sheet, reinforced with polyester fabric; smooth surfaced; suitable for torch application method.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Firestone Building Products.
      c. Johns Manville; a Berkshire Hathaway company.

2.4 ATACTIC-POLYPROPYLENE- (AAP-) MODIFIED BITUMINOUS CAP SHEET

A. Smooth-Surfaced Roofing Cap Sheet: ASTM D 6222/D 6222M, Type I or II, Grade S, APP-modified asphalt sheet, reinforced with polyester fabric; suitable for torch application method.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Firestone Building Products.
      c. Johns Manville; a Berkshire Hathaway Company.

2.5 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 4601/D 4601M, Type I, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

B. Smooth-Surfaced Flashing Sheet: ASTM D 6222/D 6222M, Type I or II, Grade S, APP-modified asphalt sheet, reinforced with polyester fabric; smooth surfaced; suitable for application method specified.

C. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668/D 1668M, Type I.

D. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

2.6 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with other roofing components.

B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

D. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required by roofing system manufacturer for application.

E. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

F. Insulation Cant Strips: ASTM C 728, perlite insulation board.

G. Metal Flashing Sheet: As specified in Section 07 6200 "Sheet Metal Flashing and Trim."

H. Miscellaneous Accessories: Provide accessories recommended by roofing system manufacturer.

2.7 COATING MATERIALS

A. Roof Coating: ASTM D 1227, Type II, Class 1, mineral-colloid-emulsified, fibered asphalt emulsion, asbestos free.

2.8 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roof membrane manufacturer,.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
   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. Atlas Roofing Corporation.
      b. Carlisle SynTec Incorporated.
      c. Firestone Building Products.
      d. GAF.
      e. Johns Manville; a Berkshire Hathaway company.
      f. Rmax, Inc.
   2. Compressive Strength: 20 psi (138 kPa).
   3. Size: 48 by 48 inches (1219 by 1219 mm).
   4. Thickness: 4 Inches.

C. Tapered Insulation: Provide factory-tapered insulation boards.
   1. Material: Match roof insulation.
   2. Minimum Thickness: 1/4 inch (6.35 mm).
   3. Slope:
      a. Roof Field: 1/4 inch per foot (1:48)unless otherwise indicated on Drawings.
      b. Saddles and Crickets: 1/2 inch per foot (1:24)unless otherwise indicated on Drawings.

2.9 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with other roofing system components.

B. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum board or ASTM C 1278/C 1278M fiber-reinforced gypsum board.
   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. Georgia-Pacific Building Products.
      c. National Gypsum Company.
      d. United States Gypsum Company.
   2. Basis-of-Design Product: Georgia Pacific Building Products; DensDeck Prime Roof Board.
   3. Material: Fiberglass mat with non-asphaltic coating.

4. Water Absorption: Less than 10 percent.
5. Compressive Strength: 900 psi.
6. Thickness:1/2 inch (13 mm).
7. Surface Finish: Factory primed.

2.10 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D 41/D 41M.

B. Roofing Asphalt: ASTM D 312/D 312M, Type III or IV as recommended by roofing system manufacturer for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation, according to roofing system manufacturer's written instructions.
1. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing," FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.
1. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

D. Coordinate installation and transition of roofing system component serving as an air barrier, with air barrier specified in Section 07 2726 "Fluid-Applied Membrane Air Barriers."

E. Start installation of roofing in presence of manufacturer's technical personnel.

F. Where roof slope exceeds 1/2 inch per 12 inches (1:24), install roofing sheets parallel with slope.

G. Coordinate installation of roofing system, so components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
1. Provide tie-offs at end of each day's work to cover exposed roofing sheets with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

H. Asphalt Heating: Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.
1. Circulate asphalt during heating.
2. Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application.

3. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating.
4. Do not heat roofing asphalt within 25 deg F (14 deg C) of flash point.
5. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
6. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

I. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 BASE-SHEET INSTALLATION

A. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature.

B. Install lapped base-sheet course, extending sheet over and terminating above cants.
1. Install base sheet in a shingle fashion.
2. Torch apply to substrate.
   a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.
3. Install base sheet without wrinkles, tears, or air pockets.
4. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.
   a. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches (76 mm).
   b. Lap end laps as recommended by roof membrane manufacturer but not less than 12 inches (300 mm).
   c. Stagger end laps not less than 18 inches (457 mm).
   d. Heat weld end laps, leaving no voids.
   e. Roll laps with a 20-pound (9-kg) roller.
5. Repair tears and voids in laps and lapped seams not completely sealed.
6. Apply pressure to the body of the base sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.5 APP-MODIFIED BITUMINOUS CAP SHEET INSTALLATION

A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature at which cap sheet will be installed.

B. Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
1. Extend cap sheet over and terminate above cants.
2. Install cap sheet in a shingle fashion.
3. Install cap sheet as follows:
4. Torch apply to substrate.
   a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.
5. Install cap sheet without wrinkles tears, or air pockets.
6. Install cap sheet, so side and end laps shed water.

C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.
1. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches (76 mm).
2. Lap end laps as recommended by roof membrane manufacturer but not less than 12 inches (300 mm).
3. Stagger end laps not less than 18 inches (457 mm).
4. Heat weld end laps, leaving no voids.
5. Roll laps with a 20-pound (9-kg) roller.
6. Repair tears and voids in laps and lapped seams not completely sealed.

D. Apply pressure to the body of the cap sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.6 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions and as follows:
   1. Prime substrates with asphalt primer if required by roofing system manufacturer.
   2. Backer Sheet Application:
      a. Mechanically fasten backer sheet to walls or parapets.
      b. Seal all laps.
   3. Backer Sheet Application:
      a. Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt.
      b. Seal all laps.
   4. Flashing Sheet Application: Torch apply flashing sheet to substrate.
      a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
   1. Seal top termination of base flashing.

D. Install liquid flashing system according to manufacturer's recommendations.
   1. Extend liquid flashing not less than 3 inches (76 mm) in all directions from edges of item being flashed.
   2. Embed granules, matching color of roof membrane, into wet compound.

E. Install roofing cap sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

F. Roof Drains: Set 30-by-30-inch (760-by-760-mm) 4-pound (1.8-kg) lead flashing in bed of asphaltic adhesive on roofing.
   1. Cover lead flashing with roofing cap sheet stripping, and extend a minimum of 4 inches (100 mm) beyond edge of metal flashing onto field of roofing.
   2. Clamp roofing, metal flashing, and stripping into roof-drain clamping ring.
   3. Install stripping according to roofing system manufacturer's written instructions.

3.7 INSULATION INSTALLATION

A. Loosely lay separator sheet over cooled roofing membrane, with minimum 2-inch (51-mm) side laps and 4-inch (100-mm) end laps.

B. Loosely lay insulation over roof membrane, with long joints of insulation in continuous straight lines and with end joints staggered not less than 12 inches (300 mm) between rows.
   1. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
   2. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   3. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

C. Install upper layer of insulation with joints of each layer offset not less than 12 inches (300 mm) from previous layer of insulation.
   1. Install with long joints continuous and with end joints staggered not less than 12 inches (300 mm) in adjacent rows.
   2. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   3. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
   4. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   5. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

3.8 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
   1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   2. At internal roof drains, conform to slope of drain sump.
      a. Trim cover board so that water flow is unrestricted.
   3. Cut and fit cover board tight to nailers, projections, and penetrations.

4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
    a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.9 MORTAR-FACED BOARD INSULATION INSTALLATION

A. Install mortar-faced board insulation loosely laid, according to manufacturer's written instructions, with tongue-and-groove joints nested.
1. Stagger end joints of adjoining rows and abut insulation.
2. Mechanically fasten metal securement strapping at penetrations and at perimeter edges of mortar-faced board insulation.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

B. Perform the following tests:
1. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
    a. Perform tests before overlying construction is placed.
    b. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (51 mm) of clearance from top of base flashing.
    c. Flood each area for 72 hours.
    d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
        1) Cost of retesting is the responsibility of the Contractor.
    e. Testing agency shall prepare survey report indicating locations of initial leaks, if any, and final survey report.
2. Infrared Thermography: Testing agency shall survey entire roof area using infrared color thermography in accordance with ASTM C 1153.
    a. Perform tests before overlying construction is placed.
    b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
    c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
        1) Cost of retesting is Contractor's responsibility.
    d. Testing agency shall prepare survey report of initial scan indicating locations of entrapped moisture, if any.
3. Testing agency shall prepare survey report indicating locations of initial discontinuities, if any.

C. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
1. Determine approximate quantities of components within roofing membrane according to ASTM D 3617/D 3617M.
2. Examine test specimens for interply voids according to ASTM D 3617/D 3617M and to comply with criteria established in Appendix 3 in 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.

D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

F. 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.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.
   1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. 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.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formed roof-drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.
3. Formed equipment support flashing.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following
1. Underlayment materials.

B. Shop Drawings: For sheet metal flashing and trim.
1. Delegated Design: Provide shop drawings signed and sealed by a structural engineer licensed to practice in the location of the project, indicating ability of system and attachment to supporting construction to resist indicated or code required loads.
2. Include plans, elevations, sections, and attachment details.
3. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
4. Include identification of material, thickness, weight, and finish for each item and location in Project.
5. Include details for forming, including profiles, shapes, seams, and dimensions.
6. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
7. Include details of termination points and assemblies.
8. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
9. Include details of roof-penetration flashing.
10. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
11. Include details of special conditions.
12. Include details of connections to adjoining work.
13. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

E. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
   1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
   1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
   2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 WARRANTY

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
   1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
   1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).
      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.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A755/A755M.
   1. Surface: Smooth, flat.
   2. Exposed Coil-Coated Finish:
      a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
1. Products: Subject to compliance with requirements,provide one of the following:
a. Carlisle Coatings & Waterproofing Inc.; Miradri 860/861.
b. GCP Applied Technologies Inc.; Grace Ultra.
c. Henry Company; Blueskin PE200HT.
d. Polyguard Products, Inc.; Deck Guard HT.
2. Source Limitations: Obtain underlayment from single source from single manufacturer.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C) or lower.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:
   1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:
   1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
   2. Fabricate in minimum 96-inch- (2400-mm-) long sections.
   3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
   4. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
   5. Gutter Profile: Style A, or as otherwise indicated on drawings, in accordance with cited sheet metal standard.
   6. Expansion Joints: Lap type.
   7. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:
      a. Galvanized Steel: 0.022 inch (0.56 mm) thick.
      b. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
   8. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:
      a. Galvanized Steel: 0.028 inch (0.71 mm) thick.
      b. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
   1. Fabricated Hanger Style: Fig. 1-35A , unless otherwise indicated on drawings, in accordance with SMACNA's "Architectural Sheet Metal Manual."
   2. Fabricate from the following materials:
      a. Galvanized Steel: 0.022 inch (0.56 mm) thick.
      b. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
   2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes. Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
   2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

E. Splash Pans: Fabricate to dimensions and shape required and from the following materials:
   1. Stainless Steel: 0.019 inch (0.48 mm) thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

B. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch (0.56 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

C. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch (0.56 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch (0.48 mm) thick.

E. Roof-Drain Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:
1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses.
5. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches (300 mm) o.c.
6. Space individual cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.

8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.
1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

3.4 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:
1. Join sections with joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Fasten gutter spacers to front and back of gutter.
6. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.
7. Anchor gutter with gutter brackets spaced not more than 24 inches (600 mm) apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
8. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet (15.2 m) apart. Install expansion-joint caps.

C. Downspouts:
1. Join sections with 1-1/2-inch (38-mm) telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
4. Connect downspouts to underground drainage system.

D. Splash Pans:
1. Set in elastomeric sealant compatible with the substrate.

E. Parapet Scuppers:
1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
3. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch (25 mm) below discharge.

G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

3.5 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Copings:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) centers.
b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch (600-mm) centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches (100 mm) over base flashing.
3. Lap counterflashing joints minimum of 4 inches (100 mm).
4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:
1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

A. Clean off excess sealants.

3.9 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

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SECTION 07 6210

FLEXIBLE FLASHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formed Products: Concealed flashing within wall assemblies to protect and shed incidental water to the exterior that is not specified as part of the air/moisture barrier system.

1.2 PERFORMANCE REQUIREMENTS

A. General: Flashing and trim assemblies as indicated shall withstand structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
1. Submit documentation of compatibility with air/moisture barrier.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store flashing materials in contact with other materials that might cause staining, denting, or other surface damage. Store flashing materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 FLEXIBLE FLASHING

A. Self-Adhesive flexible flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 40 mils.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Advanced Building Products Inc.; Strip-N-Flash.
b. Carlisle Coatings & Waterproofing; CCW-705 Air & Vapor Barrier Strips.
c. GCP Applied Technologies Inc.; Perm-A-Barrier Detail Membrane.
d. Henry; Blueskin SA

2.2 HIGH TEMPERATURE FLASHING

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.

b. GCP Applied Technologies Inc.; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, separators, sealants, and other miscellaneous items as required for complete metal flashing installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

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.
1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FLASHING INSTALLATION

A. General: Install as indicated on Drawings and per Manufacturer's recommendations.

B. Self-Adhering Sheet Flashing: Install self-adhering sheet flashing, wrinkle free. Apply primer if required by flashing manufacturer. Comply with temperature restrictions of flashing manufacturer for installation. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover flashing with subsequent construction within 14 days.

C. Location:
1. Flexible Flashing: As indicated on drawings, or at all exterior windows, doors or other penetrations where high temperature flashing is not required.
2. High Temperature Flashing: As indicated on drawings, or at all locations where flashing will be in contact with metal coping or metal panels where high temperatures exist.

END OF SECTION

SECTION 07 8413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

B. Product Certificates:
1. Certifying the non-metallic plumbing piping system and the fire sprinkler piping system manufacturers evaluated and approved the firestopping products for installation with or near its piping system.
2. Certifying the firestopping products comply with NFPA 13 requirements for material compatibility with non-metallic pipe and tubing.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by firestopping manufacturer.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

C. Ensure firestopping products are coordinated and compatible with the non-metallic plumbing piping system and the fire sprinkler piping system.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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. For penetrations involving CPVC piping, provide through-penetration firestop systems which include materials that have been tested to be compatible with CPVC piping.

B. Fire-Test-Response Characteristics:
1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."
3) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, 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. Provide firestopping, including products specified in Section 07 8443 "Joint Firestopping," by same manufacturer as products of this section regardless of installer. All firestopping products within this section shall be of one manufacturer.
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 Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. GCP Applied Technologies Inc.
d. Hilti, Inc.
e. Johns Manville.
f. Nelson Firestop Products.
g. RectorSeal Corporation.
h. Specified Technologies Inc.
i. Tremco, Inc.; Tremco Fire Protection Systems Group.
j. USG Corporation.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems 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. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems 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. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

F. Accessories: 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 system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Ensure penetration firestopping products are coordinated and compatible with one another, with the substrates forming openings, and with penetrating items.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. 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.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. 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.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
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 the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. 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. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."

C. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

D. Refer to Drawings.

END OF SECTION

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SECTION 07 8443

JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

B. Product Certificates:
1. Certifying the non-metallic plumbing piping system and the fire sprinkler piping system manufacturers evaluated and approved the joint firestopping products for installation with or near its piping system.
2. Certifying the joint firestopping products comply with NFPA 13 requirements for material compatibility with non-metallic pipe and tubing.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by firestopping manufacturer.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

C. Ensure joint firestopping products are coordinated and compatible with the non-metallic plumbing piping system and the fire sprinkler piping system.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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. For penetrations involving CPVC piping, provide through-penetration firestop systems which include materials that have been tested to be compatible with CPVC piping.

B. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."
         2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases. Provide firestopping, including products specified in Section 07 8413 "Penetration Firestopping," by same manufacturer as products of this section regardless of installer. All firestopping products within this section shall be of one manufacturer.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
   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 Fire Protection Products.
      b. A/D Fire Protection Systems Inc.
      c. GCP Applied Technologies Inc.
      d. Hilti, Inc.
      e. Johns Manville
      f. Nelson Firestop Products.
      g. RectorSeal Corporation.
      h. Specified Technologies Inc.
      i. Tremco, Inc.; Tremco Fire Protection Systems Group
      j. USG Corporation.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
   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:
   2. 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 Fire Protection Products.
      b. A/D Fire Protection Systems Inc.
      c. GCP Applied Technologies Inc.
      d. Hilti, Inc.
      e. Johns Manville
      f. Nelson Firestop Products.
      g. RectorSeal Corporation.
      h. Specified Technologies Inc.
      i. Tremco, Inc.; Tremco Fire Protection Systems Group
      j. USG Corporation.
   3. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
   3. For elastomeric 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. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. 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 - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

3.8 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

A. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under product category Firestop Systems.

3.9 FIRE-RESISTIVE JOINT SYSTEMS

A. Refer to Drawings.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Product Certificates:
1. Certifying the non-metallic plumbing piping system and the fire sprinkler piping system manufacturers evaluated and approved the joint sealant products for installation with or near its piping system.
2. Certifying the joint sealant products comply with NFPA 13 requirements for material compatibility with non-metallic pipe and tubing.

E. Field-Adhesion-Test Reports: For each sealant application tested.

F. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.
1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. 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.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
   3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with masonry substrates.
   4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
   5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
   7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each kind of sealant and joint substrate.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
         1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 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 deg F (5 deg C).
   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.

1.8 COORDINATION

A. Ensure joint sealant products are coordinated and compatible with the non-metallic plumbing piping system and the fire sprinkler piping system.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: From date of Substantial Completion.
      a. Urethane Sealants: 10 years.
      b. Silicone Sealants: 20 years.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
   1. For penetrations involving CPVC piping, provide through-penetration firestop systems which include materials that have been tested to be compatible with CPVC piping.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

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 C 920, Type S, Grade NS, Class 50, Use NT.
   1. Products: 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. Dow Corning Corporation; 795 Silicone Building Sealant (VOC: 28 g/L).
      b. GE Construction Sealants; Momentive Performance Materials Inc; SCS9000 SilPruf NB (VOC: 37 g/L).
      c. Pecora Corporation; 864NST (VOC: <100 g/L).
      d. Sika Corporation Industry Products; Sikasil WS-295 FPS (VOC: 37 g/L)
      e. Tremco Inc., Tremco CS&W Group; Spectrem 2 (VOC: 42 g/L). .

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   1. Products: 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. BASF Aktiengesellschaft; MasterSeal TX1 (VOC: 36 g/L).
      b. C.R. Laurence Co, Inc.; CRL M64 (VOC: 9 g/L).
      c. Pecora Corporation; DynaTrol I-XL (VOC: <100 g/L).
      d. Sika Corporation Industry Products; Sikaflex Textured Sealant.
      e. Tremco Inc., Tremco CS&W Group; Vulkem 116 (49 g/L).

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and 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. BASF Aktiengesellschaft; MasterSeal SL 1 (VOC: 104 g/L).
      b. Pecora Corporation; Urexpan NR-201 (VOC: <50 g/L).
      c. Sika Corporation Industry Products; Sikaflex 1c SL (VOC: 40 g/L).

C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. LymTal International, Inc.; Iso-Flex 888QC.

2.4 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, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, 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. C.R. Laurence Co, Inc.; CRL 33S Silicone (VOC: 30 g/L).
      b. Dow Corning Corporation; 786 Silicone Sealant (VOC: 33 g/L).
      c. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary (VOC: 20 g/L).
      d. Pecora Corporation; Pecora 898NST (VOC: 50 g/L).
      e. Sika Corporation Industry Products; Sikasil GP (VOC: 29 g/L).
      f. Soudal Accumetric; Silirub RTV1 (VOC: 30 g/L).
      g. Tremco Inc., Tremco CS&W Group; Tremsil 200 (VOC: 1 g/L).

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. C.R. Laurence Co, Inc.; CRL 777 Butyl Rubber (VOC: 240 g/L)..
      b. Pecora Corporation; BC-158 (VOC: <250 g/L).
      c. Tremco Inc., Tremco CS&W Group; Butyl Sealant (VOC: 232 g/L)

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
   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.R. Laurence Co, Inc.; CRL 321 (VOC: 22 g/L).
      b. Pecora Corporation; AC-20 (VOC: 20 g/L).
      c. Tremco Incorporated; Tremflex 834 (VOC: 31 g/L).

2.7 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.
   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. Alcot Plastics Ltd.; Alcot Plastics Backer Rod.
      b. BASF Aktiengesellschaft; MasterSeal 920.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   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.
   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. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
a. Perform 10tests for the first 1000 feet (300 m)of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 1000 feet (300 m)of joint length thereafter or one test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
a. Whether sealants filled joint cavities and are free of voids.
b. Whether sealant dimensions and configurations comply with specified requirements.
c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 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.

3.6 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.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
   1. Joint Locations:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Joints between different materials listed above.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Urethane, M, P, 50, T, NT.
   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.
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints between different materials listed above.
      d. Perimeter joints between materials listed above and frames of openings.
      e. Control and expansion joints in overhead surfaces.
      f. Other joints as indicated on Drawings.
   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.
   1. Joint Locations:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Control and expansion joints in ceramic tile flooring.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Urethane, S, P, 25, T, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Ceramic tile control and expansion joints.
      c. Vertical joints on exposed surfaces of walls and partitions.
      d. Other joints as indicated on Drawings.
   2. Joint Sealant: Urethane, S, NS, 25, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
   1. Joint Locations:
      a. Control joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints between interior wall surfaces and frames of interior doors.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Acrylic latex.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Concealed mastics.
   1. Joint Locations:
      a. Aluminum thresholds.
      b. Sill plates.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Butyl-rubber based.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 07 9219

ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each acoustical joint sealant.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Acoustical-Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.4 COORDINATION

A. Ensure joint sealant products are coordinated and compatible with the non-metallic plumbing piping system and the fire sprinkler piping system.

1.5 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

B. Compatibility: Provide sealants composed of components that are compatible with each other, substrates forming openings, and items penetrating sealant under conditions of service and application.
   1. For penetrations involving CPVC piping, provide sealants which include materials that have been tested to be compatible with CPVC piping.

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
   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. Franklin International; Titebond GREENchoice Professional Acoustical Smoke & Sound Sealant.
      b. GE Construction Sealants; Momentive Performance Materials Inc.

c. Grabber Construction Products.
d. Hilti, Inc.
e. OSI Sealants; Henkel Corporation.
f. Pecora Corporation; Pecora AIS-919 Acoustical and Insulation Latex Sealant.
g. United States Gypsum Company; SHEETROCK Acoustical Sealant

2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

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 acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical 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 acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

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SECTION 07 9513.13

INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior expansion joint cover assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches (150 mm) long in size.

D. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.
   7. Fire-resistance ratings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E 1966 by a qualified testing agency.
1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

B. Expansion Joint Design Criteria:
1. Type of Movement: Thermal.
a. Nominal Joint Width: As indicated on Drawings.
b. Minimum Joint Width: As indicated on Drawings.
c. Maximum Joint Width: As indicated on Drawings.

2.3 EXPANSION JOINT COVERS

A. Glide-Plate Joint Cover: Assembly consisting of center plate that slides in and out of slots in metal frames fixed to sides of joint gap.
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. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
b. Balco, Inc.
c. Construction Specialties, Inc.
d. InPro Corporation (IPC).
e. MM Systems Corporation.
f. Nystrom, Inc.
g. Watson Bowman Acme Corp.
2. Basis-of-Design Product: InPro Corporation (IPC); 300 Series Glide Plate Wall & Ceiling Expansion Joint Covers.
3. Application: Wall and ceiling as indicated on Drawings.
4. Installation: Recessed.
5. Load Capacity:
a. Uniform Load: 50 lb/sq. ft. (244 kg/sq. m).
b. Concentrated Load: 300 lb (136 kg).
c. Maximum Deflection: 0.0625 inch (1.6 mm).
6. Fire-Resistance Rating: Not less than that of adjacent construction .
7. Exposed Metal:
a. Aluminum: Clear anodic, Class I .

B. Elastomeric-Seal Floor and Wall Joint Cover: Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.
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. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
b. Balco, Inc.
c. Construction Specialties, Inc.
d. InPro Corporation (IPC).
e. MM Systems Corporation.
f. Nystrom, Inc.
g. Watson Bowman Acme Corp.
2. Basis-of-Design Product: InPro Corporation (IPC); 101 Series.
3. Application: Floor to floor and wall to wall.
4. Installation: Recessed.
5. Load Capacity:
a. Uniform Load: 50 lb/sq. ft. (244 kg/sq. m).
b. Concentrated Load: 300 lb (136 kg).
c. Maximum Deflection: 0.0625 inch (1.6 mm).
6. Fire-Resistance Rating: Not less than that of adjacent construction .
7. Exposed Metal:
a. Aluminum: Clear anodic, Class I .
8. Seal: Preformed elastomeric membrane or extrusion.
a. Color: As selected by Architect from manufacturer's full range.

C. Elastomeric-Seal Ceiling Joint Cover: Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.
   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. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
      b. Balco, Inc.
      c. Construction Specialties, Inc.
      d. InPro Corporation (IPC).
      e. MM Systems Corporation.
      f. Nystrom, Inc.
      g. Watson Bowman Acme Corp.
   2. Basis-of-Design Product: InPro Corporation (IPC); 116 Series.
   3. Application: Ceiling to ceiling.
   4. Mounting: Recessed.
   5. Fire-Resistance Rating: Not less than that of adjacent construction .
      a. Aluminum: Clear anodic, Class I .
   6. Seal: Preformed elastomeric membranes or extrusions.
      a. Color: As selected by Architect from manufacturer's full range.

2.4 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

C. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 ALUMINUM FINISHES

A. Mill finish for floors.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker for walls and ceilings.

2.6 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
   1. Provide where indicated on Drawings.

B. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
2. Install frames in continuous contact with adjacent surfaces.
a. Shimming is not permitted.
3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION

SECTION 07 9513.16

EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior building expansion joint cover assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches (150 mm) long in size.

D. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.
   7. Fire-resistance ratings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 by a qualified testing agency.
   1. Hose Stream Test: Wall-to-wall and wall-to-soffit assemblies shall be subjected to hose stream testing.

B. Expansion Joint Design Criteria:
   1. Type of Movement: Thermal.
      a. Nominal Joint Width: As indicated on Drawings.
      b. Minimum Joint Width: As indicated on Drawings.
      c. Maximum Joint Width: As indicated on Drawings.

2.3 EXTERIOR EXPANSION JOINT COVERS

A. Exterior Metal-Plate Joint Cover: Assembly consisting of sliding metal cover plate in continuous contact with gaskets mounted on metal frames fixed to sides of joint gap.
   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. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
      b. Balco, Inc.
      c. Construction Specialties, Inc.
      d. InPro Corporation (IPC).
      e. MM Systems Corporation.
      f. Nystrom, Inc.
      g. Watson Bowman Acme Corp.
   2. Application: Wall to wall.
   3. Installation: Surface mounted.
   4. Fire-Resistance Rating: Not less than that of adjacent construction.
   5. Exposed Metal:
      a. Aluminum: Clear anodic, Class I.

2.4 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

C. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.6 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
   1. Provide where indicated on Drawings.

B. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
   3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   4. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.
   5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

D. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

E. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
   1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

F. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections.

END OF SECTION

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SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:
1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.
1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, section 7.2.1.15.4.
3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Field quality control reports.

1.7 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
   1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, section 7.2.1.15.4 and the following:
   1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Ceco Door; ASSA ABLOY.
   b. Curries Company; ASSA ABLOY.
   c. DE LA FONTAINE.
   d. Fleming Door Products Ltd.; Assa Abloy Group Company.
   e. Gensteel Doors, Inc.
   f. Hollow Metal Xpress.
   g. Mesker Door Inc.
   h. Republic Doors and Frames.
   i. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
   2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. (2.84 W/K x sq. m) when tested according to ASTM C 518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B..
   1. Doors:
      a. Thickness: 1-3/4 inches (44.5 mm).
      b. Face: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
      c. Edge Construction: Model 2, Seamless.

d. Edge Bevel: Provide manufacturer's standard beveled or square edges.
e. Core: Manufacturer's standard.
f. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated and temperature-rise-rated doors.

2. Frames:
a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A..

1. Doors:
a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Polyurethane.
i. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated doors.

2. Frames:
a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 08 8000 "Glazing."

2.8 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
   1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
   4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with SDI A250.11.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
   a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
   b. Install frames with removable stops located on secure side of opening.
2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, section 5.2
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 CLEANING AND TOUCHUP

A. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 1216

ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior aluminum frames for doors installed in gypsum board partitions.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum frames:
1. Include elevations, sections, and installation details for each wall-opening condition.
2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
3. Include locations of reinforcements and preparations for hardware.
4. Include details of anchorages, joints, field splices, connections, and accessories.

C. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.3 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at project site.
1. Review metal stud and gypsum board details and installation of aluminum frames.

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. Frameworks, Inc.; an ASSA ABLOY Group company.
2. Modulex Products, Inc.
3. Versatrac Frames; a division of American Door Products Inc.
4. Wilson Partitions; a division of Arcadia, Inc.

B. Source Limitations: Obtain aluminum frames from single source from single manufacturer.

2.2 COMPONENTS

A. Aluminum Framing: ASTM B 221 (ASTM B 221M), with alloy and temper required to suit structural and finish requirements, and not less than 0.062 inch (1.6 mm) thick.

B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.

C. Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick; removable, snap-in casing trim and door stops, without exposed fasteners.
1. Trim Style: As selected by architect.

D. Doors: As specified in Section 08 1216 “Aluminum Frames.”

E. Frame and Trim Finish: Clear-anodized aluminum.

2.3 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals in black color.

C. Door Hardware: As specified in Section 08 7100 "Door Hardware."

2.4 FABRICATION

A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted and mitered connections.

B. Factory prepare aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 08 7100 "Door Hardware."

C. Fabricate components to allow secure installation without exposed fasteners.

2.5 GENERAL FINISH REQUIREMENTS

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.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that wall thickness does not exceed standard tolerances allowed by throat size of indicated aluminum frame.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.

B. Install frame components in the longest possible lengths with no piece less than 48 inches (1220 mm); components 96 inches (2450 mm) or shorter shall be one piece.
   1. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
   2. Secure clips to extruded main-frame components and not to snap-in or trim members.
   3. Do not leave screws or other fasteners exposed to view when installation is complete.
   4. Install with hairline joints.
   5. Puckering or warping of trim not acceptable.

C. Door Hardware: Install according to Section 08 7100 "Door Hardware" and aluminum-frame manufacturer's written instructions.

3.3 ADJUSTING

A. Inspect installation, correct misalignments, and tighten loose connections.

B. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and according to AAMA 609 & 610.

C. Touch Up: Repair marred frame surfaces to blend inconspicuously with adjacent unrepaired surface so touchup is not visible from a distance of 48 inches (1220 mm) as viewed by Architect. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION

SECTION 08 1416

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid-core flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors and frames.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door frame construction.
5. Factory-machining criteria.
6. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

C. Samples for Verification:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.
1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C.
1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" and WDMA I.S. 1A.
1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 SOLID-CORE FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:
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. Eggers Industries.
b. Oshkosh Door Company.
c. VT Industries Inc.

2. Performance Grade:
   a. WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
   b. WDMA I.S. 1A Extra Heavy Duty: Public toilets, janitor's closets, exits, and where indicated on Drawings.
3. Architectural Woodwork Standards Grade: Custom.
4. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.
   a. Species and Cut: Match existing.
   b. Match between Veneer Leaves: Book match unless otherwise indicated.
   c. Assembly of Veneer Leaves on Door Faces: Center-balance match.
   d. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
5. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.
   a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
   b. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
      1) Finish steel edges and astragals with baked enamel same color as doors.
   c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
      1) Screw-Holding Capability: 475 lbf (2110 N) in accordance with WDMA T.M. 10.
6. Core for Non-Fire-Rated Doors: ANSI A208.1, Grade LD-1 particleboard.
   a. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
   b. Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 7100 "Door Hardware."
7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
   a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Manufacturer's standard shape.
   3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

C. Metal Louvers:
   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. Activar Construction Products Group, Inc.
      b. Allegion plc.
      c. Anemostat Products; a Mestek company.
      d. ASSA ABLOY.
      e. L & L Louvers, Inc.
      f. McGill Architectural Products.
   2. Blade Type: Vision-proof, inverted V.
   3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
   5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 "Glazing."
   3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.
   3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:
   1. Architectural Woodwork Standards Grade: Custom.
   2. Finish: Architectural Woodwork Standards System-11, Polyurethane, Catalyzed.
   3. Staining: As scheduled.
   4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 7100 "Door Hardware."

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.
   1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3.2 mm in 2400 mm).
   2. Anchor frames to anchors or blocking built in or directly attached to substrates.
      a. Secure with countersunk, concealed fasteners and blind nailing.
      b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
         1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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SECTION 08 3113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For access doors and frames.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspecting agency.
   1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
   1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 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.

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:
   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. Acudor Products, Inc.
      b. Babcock-Davis.
      c. J. L. Industries; a division of Activar Construction Products Group.
      d. Karp Associates, Inc.
      e. Larsen's Manufacturing Company.
      f. Milcor Inc.
      g. Nystrom, Inc.
   2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
   3. Locations: Wall and ceiling.
   4. Door Size: As indicated.
   5. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
   6. Stainless Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage, ASTM A480/A480M No. 4 finish.
   7. Frame Material: Same material and thickness as door.
   8. Latch and Lock: Cam latch, screwdriver operated.

B. Recessed Access Doors with Concealed Flanges :
   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. Acudor Products, Inc.
      b. Babcock-Davis.
      c. Bauco Access Panel Solutions Inc.
      d. J. L. Industries; a division of Activar Construction Products Group.
      e. Karp Associates, Inc.
      f. Larsen's Manufacturing Company.
      g. Milcor Inc.
      h. Nystrom, Inc.
   2. Description: Door face recessed 5/8 inch (16 mm) for gypsum board infill; with concealed flange for gypsum board installation and concealed hinge.
   3. Locations: Ceiling.
   4. Door Size: As indicated.
   5. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
   6. Stainless Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage, ASTM A480/A480M No. 4 finish.
   7. Latch and Lock: Cam latch, screwdriver operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Concealed Flanges:
   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. Acudor Products, Inc.
      b. Babcock-Davis.
      c. J. L. Industries; a division of Activar Construction Products Group.
      d. Karp Associates, Inc.
      e. Larsen's Manufacturing Company.
      f. Milcor Inc.
      g. Nystrom, Inc.
   2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
   3. Locations: Wall.
   4. Door Size: As indicated.
   5. Fire-Resistance Rating: Not less than that of adjacent construction.
   6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
   7. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory primed.
   8. Frame Material: Same material, thickness, and finish as door.
   9. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

D. Frame Anchors: Same material as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

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 mounting holes, 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 panels securely attached to perimeter of frames.

D. Latch and Lock Hardware:
   1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

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. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

E. Stainless Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
   3. Run grain of directional finishes with long dimension of each piece.
      a. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates 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. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
   1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80.

3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

3.5 SCHEDULE

A. Provide access doors where indicated and in the following locations:
   1. Access required by code.
   2. Access required for servicing operable, adjustable, or resettable fire suppression, plumbing, mechanical, electrical, life safety, security, and communication systems.

B. Sizes: Provide the following unless noted otherwise:
   1. Ceilings and Soffits: 24 inches by 24 inches minimum.
   2. Toilet Rooms: 12 inches by 12 inches minimum at each fixture chase wall.

C. Materials:
   1. Uncoated steel sheet unless noted otherwise.
   2. Stainless Steel:
      a. Toilet rooms,.
      b. Walls scheduled to receive tile finish, epoxy paint, or FRP panels.

END OF SECTION

SECTION 08 4213

ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manual-swing entrance doors for interior applications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances, showing the following:
a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, 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.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For aluminum-framed entrances.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Bathology.

B. Basis-of-Design Products:
   1. Sauna Room: Bathology; SaunaTight 440.
      a. Push/Pull Set: Manufacturer’s standard factory-installed cedar.
   2. Steam Room: Bathology; SteamTight 440.
      a. Push/Pull Set: Manufacturer’s standard factory-installed stainless steel.

C. Source Limitations: Obtain all components of aluminum-framed entrance, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 ENTRANCE DOOR SYSTEMS

A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.
   1. Nominal Size: As indicated on Drawings.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:
   1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
      a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
      b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
      c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
      d. Structural Profiles: ASTM B 308/B 308M.

E. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
   1. Door Construction:
      a. Interior Doors - Standard: 4-1/2 inches by 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   2. Stile Width: As indicated.
   3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide nonremovable glazing stops on outside of door.

2.4 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 7100 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article for each entrance door, to comply with requirements in this Section.
   1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
   3. Opening-Force Requirements:
      a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
      b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
   2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Cylinders: As specified in Section 08 7100 "Door Hardware."

E. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D 2000 molded neoprene or ASTM D 2287 molded PVC.

F. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

2.5 GLAZING

A. Glazing: Comply with Section 08 8000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

D. Rigid PVC Filler.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. 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. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At interior, provide compression weather stripping at fixed stops.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

F. 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.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, 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 and to prevent impeding movement of moving joints.
   6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 9200 "Joint Sealants," to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 08 8000 "Glazing."

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION

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SECTION 08 7100

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:

a. Swinging doors.
b. Sliding doors.
c. Gates.

2. Electronic access control system components, including:

a. Biometric access control reader.
b. Electronic access control devices.

3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
4. Lead-lining door hardware items required for radiation protection at door openings.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
4. Division 13 Section “Radiation Protection” for requirements for lead-lining for door hardware at openings indicated to receive radiation protection.
5. Division 26 sections for connections to electrical power system and for low-voltage wiring.
6. Division 28 sections for coordination with other components of electronic access control system.

1.2 REFERENCES

A. UL - Underwriters Laboratories

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. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.3 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers’ technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

    a. Wiring Diagrams: For power, signal, and control wiring and including:
        1) Details of interface of electrified door hardware and building safety and security systems.
        2) Schematic diagram of systems that interface with electrified door hardware.
        3) Point-to-point wiring.
        4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

    a. Door Index; include door number, heading number, and Architects hardware set number.
    b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
    c. Type, style, function, size, and finish of each hardware item.
    d. Name and manufacturer of each item.
    e. Fastenings and other pertinent information.
    f. Location of each hardware set cross-referenced to indications on Drawings.
    g. Explanation of all abbreviations, symbols, and codes contained in schedule.
    h. Mounting locations for hardware.
    i. Door and frame sizes and materials.
    j. Name and phone number for local manufacturer's representative for each product.
    k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.

1) Submittal Sequence: Submit door hardware schedule 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 that is critical in Project construction schedule.

5. Key Schedule:

   a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation 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.
      1) 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.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product Certificates for electrified door hardware, signed by manufacturer:

   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Certificates of Compliance:

   a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
   b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.
   c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in “QUALITY ASSURANCE” article, herein.

4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
5. Warranty: Special warranty specified in this Section.

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. Name, address, and phone number of local representative for each manufacturer.
   d. Parts list for each product.
   e. Final approved hardware schedule, edited to reflect conditions as-installed.
   f. Final keying schedule

g. Copies of floor plans with keying nomenclature
h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.4 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)

a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.

2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Architectural Hardware Consultant Qualifications: 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:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.
4. Capable of producing wiring diagrams.
5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, 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.

G. 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.

1. Air Leakage Rate: 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.

H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

I. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.

J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
2. Maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.

K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Attendees: Owner, Contractor, Architect, Installer, Owner's security consultant, and Supplier’s Architectural Hardware Consultant.
2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

L. Pre-installation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

M. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

    a. Attendees: Door hardware supplier, door hardware installer, Contractor.
    b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

    a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner**,** Owner's security consultant**,** Architect and Contractor.
    b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

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.

1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys to Owner by registered mail or overnight package service.

1.6 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory 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.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

F. Direct shipments not permitted, unless approved by Contractor.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers:
1) Mechanical: 30 years.

b. Automatic Operators: 2 year.
c. Exit Devices:
1) Mechanical: 3 years.
2) Electrified: 1 year.

d. Locksets:
1) Mechanical: 3 years.
2) Electrified: 1 year.

e. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.8 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as ”Scheduled Manufacturer ” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. 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.

D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

E. 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.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

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.

C. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:

1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.
4. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.3 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series
2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series

B. Requirements:

1. Provide five-knuckle, ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 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

3. 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

4. 2 inches or thicker doors:

a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 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.
6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
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

8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
11. Provide mortar guard for each electrified hinge specified.
12. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.4 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND Series

B. Requirements:

1. Provide cylindrical locks conforming to the following standards and requirements:

a. ANSI/BHMA A156.2 Series 4000, Grade 1.
b. UL 10C for 4’-0” x 10’-0” 3-hour fire door.
c. Florida Building Code (ASTM E330, E1886, E1996) and Miami Dade (TAS 201, 202, 203) requirements for hurricanes.

2. Cylinders: Refer to “KEYING” article, herein.
3. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:

a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access

b. Cycle life - tested to minimum 10 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers.

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. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

a. Lever Design: Dane.
b. Knurled finishes at openings serving rooms considered to be hazardous.

2.5 EXIT DEVICES

LOW PROFILE PUSH BAR EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 99-series.

B. The maximum exit device projection shall be a maximum of 3-1/16” when activated. The exit device bar shall have an average minimum thickness of .201”. The pushpad surface shall be constructed of stainless steel; pushpads with plastic or Lexan coatings shall not be acceptable. Nylon bearings and stainless steel springs shall be used for long life and durability. Only torsion or compression springs are acceptable. Extension type springs are not acceptable. All device covers shall be of cast brass, deep drawn steel or stainless steel. Latchbolts shall be of stainless steel and shall have a deadlocking latch for extra security, except at full-glass or two-light glass doors requiring narrow stile device. Mounting screws shall be concealed to deter tampering. All ferrous parts shall be zinc coated to prevent rusting.

C. Single point, one quarter turn hex dogging shall be standard on panic listed devices. Optional key cylinder dogging shall be available, and furnished if so indicated in the hardware sets, on panic listed devices. Devices with hex key dogging shall be easily field converted to cylinder dogging.

D. All devices shall be listed by Underwriters Laboratories for safety as panic hardware. Fire rated devices shall be UL listed for A label and lesser class doors, 4’ x 8’ single and 8 x 8’ pair. The model number shall be located on the end cap; devices having the model number located other than on the end cap shall not be acceptable.

E. All exit devices shall have a unitized installation feature and may be cut in the field to size. Devices shall be closed on all sides with no pinch points. The pushpad shall be designed to prevent pinching of the fingers when depressed.

F. Exit Device trim to be throughbolted. Lever trim to be heavy duty forged escutcheon with free wheeling levers.

G. All exit devices shall conform to Federal Specification FF-H-1820, and be certified as meeting ANSI A156.3, Grade 1 requirements.

2.6 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Sargent
2. Acceptable Manufacturers: No Substitution

B. Requirements:

1. Provide permanent cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.

    a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
        1) 3 construction control keys
        2) 12 construction change (day) keys.

    b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.7 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Provide cylinders/cores keyed into Owner's existing factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

C. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

    a. Master Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

    a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
    b. Patent Protection: Keys and blanks protected by one or more utility patent(s).

4. Identification:

    a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
    b. Identification stamping provisions must be approved by the Architect and Owner.
    c. 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.
    d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
    e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

    a. Change (Day) Keys: 3 per cylinder/core.
    b. Master Keys: 6.

2.8 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer: Telkee
2. Acceptable Manufacturers: HPC, Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

    a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    b. Provide hinged-panel type cabinet for wall mounting.

2.9 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action cast iron cylinder.
3. Closer Body: 1-1/4 inch (32 mm) diameter, with 5/8 inch (16 mm) diameter 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**.** OPTION LCN No Substitute: Cylinder body to have “FAST” power adjust speed dial to visually indicate spring power.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: not permitted.
8. 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.

2.10 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.

3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.11 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide kick plates, mop plates, and armor plates 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 of plates:

   a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
   b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
   c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.12 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.13 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives

2. Acceptable Manufacturers: Burns, Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.14 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Reese

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:

a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width

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.

2.15 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

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.

2.16 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 630 (US32D)
3. Continuous Hinges: BHMA 628 (US28)
4. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
5. Protection Plates: BHMA 630 (US32D)
6. Overhead Stops and Holders: BHMA 630 (US32D)
7. Door Closers: Powder Coat to Match
8. Wall Stops: BHMA 630 (US32D)
9. Latch Protectors: BHMA 630 (US32D)
10. Weatherstripping: Clear Anodized Aluminum

11. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 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.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

A. Mounting Heights: 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

I. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.

J. Lead Protection: Lead wrap hardware penetrating lead-lined doors. Levers and roses to be lead lined. Apply kick and armor plates on lead-lined doors with adhesive as recommended by manufacturer.

K. Wiring: Coordinate with Division 26, ELECTRICAL sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Testing and labeling wires with Architect’s opening number.

L. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

M. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

N. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

Q. 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.

R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

T. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 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. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary 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.

3.7 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Hardware Sets:

1. Refer to attached document.

END OF SECTION

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DOOR HARDWARE SCHEDULE

49065 OPT0207285 Version 1
Hardware Group No. 001
For use on Door #(s):
X110
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	NOTE	EXISTING DOOR/HARDWARE TO REMAIN		UNK

Hardware Group No. 201
For use on Door #(s):
116
Provide each SGL 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	ND80HD RHO	626	SCH
1	EA	PERMANENT CORE	TYPE AS REQ TO MATCH EXISTING KEY SYSTEM - MATCH EXISTING KEY SYSTEM	626	SAR
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	626	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER

Hardware Group No. 207
For use on Door #(s):
108
Provide each SGL 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	ND80HD RHO	626	SCH
1	EA	PERMANENT CORE	TYPE AS REQ TO MATCH EXISTING KEY SYSTEM - MATCH EXISTING KEY SYSTEM	626	SAR
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER

Hardware Group No. 301
For use on Door #(s):
107 110A
Provide each SGL 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	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	626	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER

Hardware Group No. 303
For use on Door #(s):

117A	117B	117C	117D	117E	117F
117G	128A	128B	128C	128D	128E

Provide each SGL 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	ND40S RHO	626	SCH
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER

Hardware Group No. 307
For use on Door #(s):

113A	114	130	131

Provide each SGL 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	ND40S RHO	626	SCH
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER

Hardware Group No. 401C-1
For use on Door #(s):

118	119	126	127

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER

Hardware Group No. 503
For use on Door #(s):

104	109

Provide each SGL 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	ND70HD RHO	626	SCH
1	EA	PERMANENT CORE	TYPE AS REQ TO MATCH EXISTING KEY SYSTEM - MATCH EXISTING KEY SYSTEM	626	SAR
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER

Hardware Group No. 715
For use on Door #(s):
132
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	99-NL-OP-110MD	626	VON
1	EA	RIM/MORTISE CYLINDER AS REQ	TYPE AS REQ TO MATCH EXISTING KEY SYSTEM W/ KEYED CONSTRUCTION CORE - MATCH EXISTING CORE TYPE - PROVIDE KEYED CONSTRUCTION CORE	626	SAR
1	EA	PERMANENT CORE	TYPE AS REQ TO MATCH EXISTING KEY SYSTEM - MATCH EXISTING KEY SYSTEM	626	SAR
1	EA	OFFSET PULL	8190 10"	626	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	626	IVE
1	EA	RAIN DRIP	142A +4" OVER DOOR WIDTH	AL	ZER
1	EA	GASKETING	328 X (HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A - LENGTH AS REQ	A	ZER
1	EA	THRESHOLD	65A LENGTH AS REQ	A	ZER

Hardware Group No. 801
For use on Door #(s):
112 117 120 125 128 129
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PUSH PLATE	8200 4" X 16"	626	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"	626	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	626	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER

Hardware Group No. C201
For use on Door #(s):
103 210 211 212
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU STOREROOM LOCK	ND80HDEU RHO RX CON 12V/24V DC	626	SCH
1	EA	PERMANENT CORE	TYPE AS REQ TO MATCH EXISTING KEY SYSTEM - MATCH EXISTING KEY SYSTEM	626	SAR
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	626	IVE
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	SET	SEALS	188S H & J (USE SILENCERS @ NON-RATED/NON-SMOKE DOORS)	BLK	ZER
2	EA	HARNESS (1 IN DOOR & 1 IN FRAME)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	CREDENTIAL READER	CARD READER BY ANOTHER SECTION		
1	EA	POWER SUPPLY	POWER SUPPLY BY SECURITY CONTRACTOR		UNK

END OF DOCUMENT

SECTION 08 8000

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Glass for doors and interior borrowed lites.
2. Glazing sealants and accessories.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated Design: Provide shop drawings signed and sealed by a structural engineer licensed to practice in the location of the project, indicating ability of system and attachment to supporting construction to resist indicated or code required loads.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Preconstruction adhesion and compatibility test report.

D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. 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.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

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. Cardinal Glass Industries.
   2. Guardian Industries Corp.; SunGuard.
   3. Oldcastle BuildingEnvelope™.
   4. Pilkington North America.
   5. Vitro (Formerly PPG).

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design glazing.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 6 mm.

D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C 1048, 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.

C. Heat-Strengthened Float Glass: ASTM C 1048, 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.

2.5 GLAZING SEALANTS

A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Dow Corning Corporation; 790.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. Bondaflex Sil 290.
d. Pecora Corporation; 890NST.
e. Sikasil WS-290.
f. Tremco Incorporated; Spectrem 1

C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, 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. GE Advanced Materials - Silicones; SilGlaze II SCS2800.
c. Pecora Corporation; 864.
d. Polymeric Systems, Inc.; PSI-641.
e. Tremco Incorporated; Spectrem 2.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of 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. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, 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 lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) 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 where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings 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.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. 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 buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type : Clear annealed float glass.
   1. Minimum Thickness: 6 mm.

B. Glass Type : Clear fully tempered float glass.
   1. Minimum Thickness: 6 mm.
   2. Safety glazing required.

END OF SECTION

SECTION 08 8300

MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of silvered flat glass mirrors:
   1. Tempered glass mirrors qualifying as safety glazing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

1.3 QUALITY ASSURANCE

A. 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.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.
   1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
   1. Warranty Period: Five years 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. Binswanger Mirror; a division of Vitro America, Inc.
   2. Gardner Glass, Inc.
   3. Glasswerks LA, Inc.
   4. Guardian Industries Corp..
   5. Virginia Mirror Company, Inc.
   6. Walker Glass Co., Ltd.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.
1. Nominal Thickness: 6.0 mm .

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
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. Palmer Products Corporation.
b. Pecora Corporation.

2.4 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Andscot Company, Inc.
2) Laurence, C. R. Co., Inc.
3) Stylmark, Inc.
2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Andscot Company, Inc.
2) Laurence, C. R. Co., Inc.
3) Stylmark, Inc.
3. Finish: Clear bright anodized.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

A. Fabricate mirrors in the shop to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished.
1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
   1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

B. Provide a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
   1. Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
   2. Install mastic as follows:
      a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
      b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
      c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

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SECTION 08 8700

GLAZING SURFACE FILMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes film products applied to glass surfaces.

1.2 DEFINITIONS

A. Minimum Peel Strength: 2,000 grams per inch, average of two specimens when tested in accordance with ASTM D 3330.

1.3 ACTION SUBMITTALS

A. Product Data: For each film product indicated.

B. Samples for Color Selection: Manufacturer's standard sample sets showing the full range of colors available for each type of product indicated.

C. Samples for Verification: 12-inch square samples of each type of glazing film specified, in color specified.

D. Shop Drawings: Identify location for each type of film indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 CLOSEOUT SUBMITTALS

A. Warranty: Special warranty specified in this Section.

B. Maintenance Data and Replacement Instructions: For each type of film overlay to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a firm experienced in manufacturing systems similar to those indicated for this Project and meeting the standards of the International Standards Organization (ISO), ISO 9001 Quality Assurance in Production and Installation.

B. Installer Qualifications: Engage an experienced installer certified, licensed, or otherwise qualified by film manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements.

C. Source Limitations: Obtain each type of film overlay through one source from a single manufacturer to provide products of consistent quality in appearance and physical properties.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store and protect glazing films according to manufacturer's written instructions and as needed to prevent damage, condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with film installation when ambient and substrate temperature conditions are outside limits permitted by manufacturer and when glass substrates are wet from frost, condensation, or other causes.

1.9 WARRANTY

A. Manufacturer's Warranty: Fully executed warranty, written in favor of the Owner, agreeing to replace films that deteriorate as defined in "Definitions" Article, within 5 years from date of original installation.

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. CPFilms Inc.; LLumar Films.
   2. 3M
   3. Solyx , SimGlas
   4. Huper Optik

2.2 GLAZING SURFACE FILMS

A. Film Overlay: Single-layered applied glazing film products, applied to interior glass surfaces, consisting of the following (from outboard surface to inboard surface), as applicable to each type of film indicated:
   1. Removable release liner.
   2. Pressure sensitive adhesive with integral ultraviolet absorbers.
   3. Clear, dyed, or printed pattern layer of polyester film.
   4. Possible layer of metallized or sputtered polyester film.
   5. Possible scratch resistant coating.

B. Colors: As scheduled.

C. Basis-of-Design Product: As scheduled.

2.3 GLAZING FILM ACCESSORIES

A. General: Provide products complying with requirements of glazing film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Adhesive: Pressure Sensitive acrylic adhesive system.

C. Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass and surrounding adjacent surfaces for conditions affecting installation.
   1. Report conditions that may adversely affect installation. In report, include description of any glass that is broken, chipped, cracked, abraded, or damaged in any way.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Immediately before beginning installation of films, clean glass surfaces of substances that could impair glazing film's bond, including mold, mildew, oil, grease, dirt and other foreign materials.

C. Blade the inside surface of window glass with industrial razors to ensure removal of foreign contaminants.

D. Protect window frames and surrounding surfaces and materials from damage during installation.

3.3 INSTALLATION

A. General: Comply with glazing film manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements are indicated.

B. Install film continuously, but not necessarily in one continuous length. Install with no gaps or overlaps.

C. If seamed, install with no gaps or overlaps. Install seams vertical and plumb. No horizontal seams allowed.

D. Do not remove release liner from film until just before each piece of film is cut and ready for installation.

E. Install film with mounting solution and custom cut to the glass with neat, square comers and edges to within 1/8 inch of the window frame.

F. Remove air bubbles, wrinkles, blisters, and other defects.

G. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, banding, thin spots or pinholes.
   1. If installed film does not meet this criteria, remove and replace with new film.

3.4 CLEANING

A. Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.

B. After application of film, wash film using cleaning methods recommended by glazing film manufacturer. Do not use abrasive-type cleaning agents or bristle brushes.

C. Replace films that cannot be cleaned.

END OF SECTION

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SECTION 09 0561.13

MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

1.2 UNIT PRICES

A. Work of this Section is affected by Moisture Vapor Emission Control Unit Price.

1.3 DEFINITIONS

A. MVE: Moisture vapor emission.

B. MVER: Moisture vapor emission rate.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Product Test Reports: For each MVE-control system, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Preinstallation testing reports.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.

1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F (18 deg C) and not more than 85 deg F (29.4 deg C) at least 48 hours before use.
2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29.4 deg C) and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F (3 deg C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
   1. MVER: Maximum 25 lb of water/1000 sq. ft. (11.34 kg of water/92.9 sq. m) when tested according to ASTM F 1869.
   2. Relative Humidity: Maximum 100 percent when tested according to ASTM F 2170 using in situ probes.

B. Water-Vapor Transmission: Through MVE-control system, maximum 0.10 perm (5.75 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M.

C. Tensile Bond Strength: For MVE-control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D 7234.

2.2 MVE-CONTROL SYSTEM

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. ARDEX Americas; ARDEX MC RAPID One-Coat Moisture Control System For Concrete to Receive ARDEX Underlayments.
   2. Floor Seal Technology, Inc.; MES 100.
   3. H.B. Fuller Construction Products Inc. / TEC; LiquiDam.
   4. KOSTER American Corporation; VAP I 2000 FS.
   5. LATICRETE SUPERCAP, LLC; LATICRETE SUPECAP Moisture Vapor Control.
   6. MAPEI Corporation; Planseal VS.
   7. Synthetics International; Synthetic30.
   8. USG Corporation; USG Durock Brand RH-100 Moisture Vapor Reducer.

B. MVE-Control System: ASTM F 3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.
   1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
   2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

2.3 ACCESSORIES

A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi (20.68-MPa) compressive strength after 28 days when tested according to ASTM C 109/C 109M.

B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.

C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's hydraulic cement-based underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Preinstallation Testing:
   1. Testing Agency: Engage a qualified testing agency to perform tests.

2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Install MVE-control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Internal Relative Humidity Test: Using in situ probes, ASTM F 2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.
4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE-control system to prepared concrete substrate and test according to ASTM D 7234.
    a. Proceed with installation only where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.

B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.
1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
2. Provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
5. Fill surface depressions and irregularities with patching and leveling material.
6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.

C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

A. General: Install MVE-control system according to ASTM F 3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
1. Install primers as required to comply with manufacturer's written instructions.

B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.

C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.

D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.

E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

F. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform installation inspections.

B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.
1. Verify that surface preparation meets requirements.
2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.

C. MVE-control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.

B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION

SECTION 09 2216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Span and Deflection Design Criteria: Provide height to load deflection charts showing studs supplied conform to deflection limit scheduled and allowed per ASTM C 754.
1. Mark on chart(s) showing all major partitions scheduled conformance with criteria.
2. Submit manufacturer's certification of stud size, thickness, and spacing complying with performance requirements and selections made by architect are correct for application shown.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

1.5 SEQUENCING

A. Coordinate placement of concealed internal wall reinforcement, such as backing plates, for items to be attached to metal support systems.

B. Coordinate installation of ceiling and soffit suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorage to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

C. Furnish concrete inserts, and other devices indicated, to other trades for installation well in advance of time needed for coordination with other construction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202 "Code of Standard Practice."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members" and ASTM C645, Section 10, unless otherwise indicated.

B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

D. Horizontal Deflection:
1. Minimum Base-Metal Thickness: 25 gage unless indicated otherwise on Drawings or below.
2. Interior Metal Stud/Gypsum Board Assemblies, Typical Locations: Withstand lateral loading (air pressure) of 5 psf with deflection limit not more than L/240 of partition height.
3. Interior Metal Stud/Gypsum Board Assemblies at Atriums, Lobbies, Service Corridors, Exit Corridors, Elevator Lobbies, Vertical Shafts, and walls receiving plaster veneer: Withstand lateral loading (air pressure) of 7.5 psf with deflection limit not more than L/360 of partition height.
4. Interior Metal Stud/Gypsum Board Assemblies at Locations with Ceramic Tile or Other Hard Surface Finishes: Withstand typical lateral loading (air pressure) with deflection limit not more than L/360 of partition height, minimum 22 gage studs at 16 inches on center.
5. Where wall mounted equipment, woodwork, and casework items are indicated or elsewhere as shown on Drawings, provide minimum 16 gage studs.
6. Where cementitious backer units are indicated, provide minimum 0.033-inch (22-gage) thick studs.
7. At jambs of openings provide two minimum 20 gage studs.
8. Ceilings: At ceilings using mold-mildew resistant gypsum framing to be 16 inches o.c. for 5/8 inch gypsum.
9. Refer to Division 05 for stud framing which is exposed to wind loads and for studs carrying heavy vertical loads, such as, cement plaster, manufactured stone masonry, stone tile thicker than 3/4 inch, etc.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 and ASTM C645 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: Comply with AISI S220 and ASTM A 653/A 653M, G40 (Z120) or coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated. ,
   a. Coating roll-formed from steel complying with mechanical and chemical requirements of ASTM A1003 with a zinc-based coating.
   b. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction

B. Studs and Tracks: AISI S220 and ASTM C 645, Section 10
1. Steel Studs and Tracks:
   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) CEMCO.
      2) ClarkDietrich
      3) Custom Stud.
      4) MarinoWARE.
      5) MBA Building Supplies.
      6) MRI Steel Framing, LLC.
      7) Phillips Manufacturing Co.
      8) SCAFCO Steel Stud Company.
      9) Steel Network, Inc. (The).
      10) Telling Industries
   b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection .
   c. Depth: As indicated on Drawings .

C. Slip-Type Head Joints: Where studs are continuous from floor to structure above, provide one of the following:
1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch (38-mm) minimum vertical movement.
   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) CEMCO; California Expanded Metal Products Co.
      2) ClarkDietrich Building Systems.
      3) Fire Trak Corp.

4) MarinoWARE.
5) SCAFCO Steel Stud Company.
6) Steel Network, Inc. (The).
7) Super Stud Building Products Inc.

2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   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) Blazeframe Industries.
      2) CEMCO; California Expanded Metal Products Co.
      3) ClarkDietrich Building Systems.
      4) MarinoWARE.
      5) MBA Building Supplies.
      6) Metal-Lite.
      7) Perfect Wall, Inc.
      8) SCAFCO Steel Stud Company.
      9) Steel Network, Inc. (The).
      10) Telling Industries.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   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. Blazeframe Industries.
      b. CEMCO; California Expanded Metal Products Co.
      c. ClarkDietrich Building Systems.
      d. Fire Trak Corp.
      e. MarinoWARE.
      f. Metal-Lite.
      g. Perfect Wall, Inc.
      h. SCAFCO Steel Stud Company.
      i. Steel Network, Inc. (The).

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   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. ClarkDietrich Building Systems.
      b. MarinoWARE.
      c. MRI Steel Framing, LLC.
      d. SCAFCO Steel Stud Company.
   2. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   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. ClarkDietrich Building Systems.
      b. MarinoWARE.
      c. MRI Steel Framing, LLC.
      d. SCAFCO Steel Stud Company
   2. Depth: As indicated on Drawings.
   3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   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. ClarkDietrich Building Systems.
      b. MarinoWARE.

c. MRI Steel Framing, LLC.
d. SCAFCO Steel Stud Company
2. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
3. Depth: 7/8 inch (22.2 mm).

H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
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. ClarkDietrich Building Systems.
b. MarinoWARE.
c. MRI Steel Framing, LLC.
d. SCAFCO Steel Stud Company
2. Configuration: Asymmetrical.

I. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 3/4 inch (19 mm).
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:
1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.
a. Uses: Securing hangers to structure.
b. Type: Torque-controlled, expansion anchor.
c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: As indicated on Drawings.

F. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
2. Steel Studs and Tracks: AISI S220 and ASTM C 645.
a. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
b. Depth: 1-5/8 inches (41 mm).
3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
a. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
a. Configuration: Asymmetrical.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
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. Armstrong World Industries, Inc.
b. ROCKWOOL International (formerly Chicago Metallic Corporation).

c. United States Gypsum Company.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:
1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb unless otherwise indicated.
   b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
   c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

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SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior gypsum board.
2. Tile backing panels.
3. Texture finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
1. Build mockups for the following:
a. Each level of gypsum board finish indicated for use in exposed locations.
b. Each texture finish indicated.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C 1396/C 1396M.
   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. American Gypsum.
      b. CertainTeed Corporation.
      c. Continental Building Products, LLC.
      d. Georgia-Pacific Building Products.
      e. National Gypsum Company.
      f. PABCO Gypsum.
      g. United States Gypsum Company.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. American Gypsum; 5/8 inch FireBloc Type X Gypsum Wallboard.
      b. CertainTeed Corporation; Type X Gypsum Board.
      c. Continental Building Products, LLC; Firecheck Type X.
      d. Georgia-Pacific Building Products; ToughRock Fireguard X Gypsum Board.
      e. National Gypsum Company; Gold Bond Brand Fire-Shield Gypsum Board.
      f. PABCO Gypsum; Flame Curb Type X.
      g. United States Gypsum Company; USG Sheetrock Brand Firecode X Gypsum Panels.
   2. Thickness: 5/8 inch (15.9 mm).
   3. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. American Gypsum; 1/2” Interior Ceiling Board.
      b. CertainTeed Corporation; Interior Ceiling Gypsum Board.
      c. Continental Building Products, LLC; Sagcheck.
      d. Georgia-Pacific Building Products; ToughRock Span 24 Ceiling Board.
      e. PABCO Gypsum; Interior Ceiling Sag-Resistant Ceiling Panel.
      f. United States Gypsum Company; Imperial Sag-Resistant Interior Ceiling Gypsum Base.
   2. Thickness: 1/2 inch (12.7 mm).
   3. Long Edges: Tapered.

D. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
   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. American Gypsum.
      b. CertainTeed Corporation.
      c. Continental Building Products, LLC.
      d. Georgia-Pacific Building Products.
      e. National Gypsum Company.
      f. PABCO Gypsum.
      g. United States Gypsum Company.
   2. Core: 5/8 inch (15.9 mm), Type X.
   3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
   4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
   5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
   6. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements according to test in Annex A1.
   7. Long Edges: Tapered.
   8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

E. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. American Gypsum ;5/8” M-Bloc Type X with Mold & Moisture Resistance.
      b. CertainTeed Corporation; M2Tech, Type X.
      c. Continental Building Products, LLC; Mold Defense, Type X.
      d. Georgia-Pacific Building Products; ToughRock Mold-Guard.

e. National Gypsum Company; Gold Bond Brand XP Fire-Shield.
f. PABCO Gypsum; Mold Curb Plus, Type X.
g. United States Gypsum Company; USG Sheetrock Brand Mold Tough® Gypsum Panels, Type X.

2. Core:5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 SPECIALTY GYPSUM BOARD

A. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Continental Building Products, LLC; Weather Defense Platinum Interior Type X.
b. Georgia-Pacific Building Products; DensArmour Plus.
c. National Gypsum Company; eXP Interior Extreme.
d. United States Gypsum Company; USG Sheetrock Brand Glass-Mat Panels Mold Tough.
2. Core: 5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
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 Corp.; FiberCement.
b. Custom Building Products; Wonderboard.
c. National Gypsum Company; Permabase Cement Board.
d. USG Corporation; DUROCK Cement Board.
2. Thickness: As indicated.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Fry Reglet Corp.
b. Gordon, Inc.
c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:
   1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Electrical Box Pads: Putty Pads: Moldable non-curing one component, intumescent, fire-rated material for through-penetration fire stop systems and sound attenuation systems; self-adhering; 1/8-inch thick minimum.

E. Acoustical Sealant: Refer to Section 07 9219 “Acoustical Joint Sealants.”

F. Thermal Insulation: As specified in Section 07 2100 "Thermal Insulation."

2.9 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.
   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. National Gypsum Company.
      c. United States Gypsum Company.
   2. Texture: Orange peel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ELECTRICAL BOX PADS FOR SMOKE / FIRE-RATED AND STC-RATED WALLS

A. Prior to installing wallboards, install electrical box pads in accordance with manufacturer’s written instructions.

B. Overlap front edge of box so that pad will be compressed around edges of box as gypsum panels are installed.

3.3 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.4 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: Vertical surfaces unless otherwise indicated.
   2. Ceiling Type: Ceiling surfaces except at fire rated ceilings, then use Type X.
   3. Impact-Resistant Type: As indicated on Drawings.
   4. Mold-Resistant Type: As indicated on Drawings.
   5. Glass-Mat Interior Type: As indicated on Drawings and the following.
      a. Interior side of exterior walls.
      b. Interior partitions where Contractor chooses to install gypsum board prior to building dry-in.
      c. At urinal and toilet fixtures as indicated on Drawings.
   6. Tile Backer, Cementitious Backer Unit Type:
      a. Walls in toilet room with shower.
      b. On tile walls, unless noted otherwise.
      c. Behind prefabricated shower or bathtub units.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing)unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.5 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use where indicated.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
   a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
5. Level 5: At locations indicated to have vinyl graphics applied.
   a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions,

texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.9 RATED PARTITION IDENTIFICATION

A. At fire-rated wall and smoke partition assemblies, provide an identification of wall rating in 4-inch high stenciled block letters in red paint. Space identifications 12 feet on center maximum, 4 feet from corners maximum, above ceiling. Provide identification on both sides of wall.

B. Partition Identification Text: Apply the following, as applicable:
1. WARNING: SMOKE PARTITION – PROPERLY SEAL ALL OPENINGS.
2. WARNING: 1-HOUR SMOKE BARRIER – PROPERLY SEAL ALL OPENINGS.
3. WARNING: 1-HOUR FIRE PARTITION – PROPERLY SEAL ALL OPENINGS.
4. WARNING: 1-HOUR FIRE BARRIER – PROPERLY SEAL ALL OPENINGS.
5. WARNING: 2-HOUR FIRE WALL – PROPERLY SEAL ALL OPENINGS.
6. WARNING: 2-HOUR FIRE BARRIER – PROPERLY SEAL ALL OPENINGS.

C. Refer to Section 09 9123 "Interior Painting" for painting requirements.
1. Use interior semi-gloss, latex, low VOC paint.

3.10 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before installing gypsum board ceilings, conduct an above-ceiling inspection, and report and correct deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for Contractor’s above-ceiling inspection. Provide Architect with copy of deficiencies report. Architect reserves the right to supplement Contractor’s deficiency report with other incomplete or incorrect items that might be observed during Architect’s site visit.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
a. Installation of 80 percent of lighting fixtures, powered for operation.
b. Installation, insulation, and leak and pressure testing of water piping systems.
c. Installation of air-duct systems.
d. Installation of air devices.
e. Installation of mechanical system control-air tubing.
f. Installation of ceiling support framing.
g. Touch-up/patching of spray fire-resistive materials (SFRM).
h. Installation of penetration firestopping in fire- and smoke-rated partitions.
i. Installation of fire-resistant joint sealants in fire-rated partitions.
j. Installation of acoustical sealants at adjacent sound-rated partitions.
a. Application of fire- and smoke-rated partition identification.

3.11 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09 3000

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ceramic mosaic tile.
2. Porcelain tile.
3. Stone tile.
4. Glazed wall tile.
5. Waterproof membrane for thinset applications.
6. Crack isolation membrane.
7. Metal edge strips.

B. Related Requirements:
1. Section 09 2900 "Gypsum Board" for cementitious backer units.
2. Section 09 6623 “Resinous Matrix Terrazzo Flooring” for precast terrazzo units.
3. Section 13 1104 “Swimming Pool Ceramic Tile” for submersible tile assemblies.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, ANSI A108.17, and ANSI A108.19 which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

E. Large format gauged porcelain tiles are 8 mm or less in thickness, and having a face dimension up to 60 inches wide and 118 inches long.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:
1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Metal edge strips in 6-inch (150-mm) lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
   2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
   3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.
   4. the U.S. Department of Labor as Journeyman Tile Layers.
   5. Installer of large format gauged porcelain tile panels shall have completed advanced certification training (ACT)

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of each type of floor tile installation.
   2. Build mockup of each type of wall tile installation.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of tile system that fail in materials or workmanship within specified warranty period, when the products are installed within their shelf life and according to governmental regulations and manufacturer’s written materials which are in effect at the time installation.
   1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
   1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
   2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
   1. Waterproof membrane.
   2. Crack isolation membrane.
   3. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 (and A137.3 for large format tiles) for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

E. Dynamic Coefficient of Friction (level interior tiles that will be walked on when wet) per ANSI A137.1: DCOF (Dynamic Coefficient of Friction) of 0.42, DCOF, per DCOF AcuTestSM method.

F. Large format gauged porcelain tiles shall meet material and installation standards of ANSI A137.3 Standard Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.

2.3 TILE PRODUCTS

A. As Scheduled.

2.4 WATERPROOFING AND CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
      b. H.B. Fuller Construction Products Inc. / TEC; Hydraflex Waterproofing Crack Isolation Membrane.
      c. LATICRETE SUPERCAP, LLC; Laticrete 9235 Waterproof Membrane.
      d. MAPEI Corporation; Mapelastic CI.

2.5 SETTING MATERIALS

A. Medium-Bed (Large and Heavy Tile), Modified Dry-Set Mortar: Comply with requirements in ANSI A118.4, A118.11, and ISO13007 C2TES1P1. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Custom Building Products; Marble, Granite & Travertine Premium Medium Bed Mortar.
      b. H.B. Fuller Construction Products Inc. / TEC TEC Ultimate Large Tile Mortar TA 382 / 383.
      c. LATICRETE SUPERCAP, LLC; 4-XLT.
      d. MAPEI Corporation; Ultraflex LFT .
   2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.

B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15, A118.11, and ISO 13007 C2ES1P1.
   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. Custom Building Products; CEGLite™ 100% Solids Commercial Epoxy Grout.
      b. LATICRETE SUPERCAP, LLC; LATICRETE® SUPERCAP™ Moisture Vapor Control.
      c. MAPEI Corporation; Floor Tile Mortar.
   2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.6 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7 and ISO 13007 CG2FAW.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Custom Building Products; Prism Color Consistent Grout.
      b. H.B. Fuller Construction Products Inc. / TEC; TEC Power Grout.
      c. LATICRETE SUPERCAP, LLC; Permacolor.
      d. MAPEI Corporation; Ultracolor Plus.
   2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Custom Building Products; CEG Lite 100% Solids Commercial Epoxy Grout.
      b. H.B. Fuller Construction Products Inc. / TEC; AccuColor EFX Epoxy Special Effects Grout.
      c. LATICRETE SUPERCAP, LLC; SpectraLOCK Pro Premium.
      d. MAPEI Corporation; Kerapoxy CQ.
   2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
   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. Blanke Corporation.
      b. Ceramic Tool Company, Inc.
      c. Schluter Systems L.P.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout as approved by grout manufacturer.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
      a. Tile floors in wet areas.
      b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
      c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm) unless scheduled otherwise.
   2. Glazed Wall Tile: 1/16 inch (1.6 mm) unless scheduled otherwise.
   3. Porcelain Tile: 1/4 inch (6.4 mm) unless scheduled otherwise.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

K. Floor Sealer: Apply floor sealer to grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOFING AND CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Ceramic Tile Installation: TCNA F113; thinset mortar.
      a. Ceramic Tile Type: As scheduled.
      b. Thinset Mortar: Improved modified dry-set mortar.
      c. Grout: High-performance sanded grout.
   2. Ceramic Tile Installation: TCNA F115; thinset mortar; epoxy grout.
      a. Ceramic Tile Type: As scheduled.
      b. Thinset Mortar: Improved modified dry-set mortar.
      c. Grout: Water-cleanable epoxy grout.
   3. Ceramic Tile Installation: TCNA F122; thinset mortar on waterproof membrane.
      a. Ceramic Tile Type: As scheduled.
      b. Thinset Mortar: Improved modified dry-set mortar.
      c. Grout: High-performance sanded grout.
   4. Ceramic Tile Installation: TCNA F125-Full; thinset mortar on crack isolation membrane.
      a. Ceramic Tile Type: As scheduled.
      b. Thinset Mortar: Improved modified dry-set mortar.
      c. Grout: High-performance sanded grout.
   5. Large Format Gauged Tile Panels:
      a. Mortar: Medium bed modified dry-set mortar.
      b. Grout: High-performance sanded grout.

6. Ceramic Tile Installation: TCNA F131; water-cleanable, tile-setting epoxy; epoxy grout.
   a. Ceramic Tile Type: As scheduled.
   b. Grout: Water-cleanable epoxy grout.
7. Dynamic Coefficient of Friction at Wet Floors: 0.42 minimum.

B. Interior Wall Installations, Wood or Metal Studs or Furring:
1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board over waterproofing membrane.
   a. Ceramic Tile Type: As scheduled
   b. Thinset Mortar: Improved modified dry-set mortar.
   c. Grout: High-performance sanded grout.
2. Large Format Gauged Tile Panels:
   a. Mortar: Medium bed modified dry-set mortar.
   b. Grout: High-performance unsanded grout.

C. Bathtub/Shower Wall Installations, Wood or Metal Studs or Furring:
1. Ceramic Tile Installation: TCNA B412; thinset mortar on cementitious backer units or fiber-cement backer board.
   a. Ceramic Tile Type: As scheduled.
   b. Thinset Mortar: Improved modified dry-set mortar.
   c. Grout: Water-cleanable epoxy grout.

END OF SECTION

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SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. The Work of this Section is affected by Section 01 2300 “Alternates.”

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
   1. Acoustical Panels: Samples of each type, color, pattern, and texture in manufacturer’s standard sample size, minimum 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Ceiling suspension-system members.
   2. Structural members to which suspension systems will be attached.
   3. Method of attaching hangers to building structure.
      a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
   4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
   5. Size and location of initial access modules for acoustical panels.
   6. Items penetrating finished ceiling and ceiling-mounted items including the following:
      a. Lighting fixtures.
      b. Diffusers.
      c. Grilles.
      d. Speakers.
      e. Sprinklers.
      f. Access panels.
      g. Perimeter moldings.
   7. Minimum Drawing Scale: 1/4 inch = 1 foot (1:48).

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size panels equal to 2percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical ceiling area as directed by Architect.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class Aaccording to ASTM E 1264.
   2. Smoke-Developed Index:450or less.

2.3 ACOUSTICAL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corp.
   3. Rockfon (Roxul, Inc.)
   4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Basis-of-Design Product: Armstrong World Industries, Inc; Ultima High NRC Square Lay-in.
   1. Classification: Provide fire-resistance-rated panels complying with ASTM E 1264 for type, form, and pattern as follows:
      a. Type and Form: Type and Form: Type III, mineral base with painted Finish; Form 2, water felted.
      b. Pattern: E (lightly textured).
   2. Color: White.
   3. LR: Not less than 0.88.
   4. NRC: Not less than 0.80.
   5. CAC: Not less than 35.
   6. Edge/Joint Detail: Square.
   7. Thickness: 7/8 inch.
   8. Modular Size: 24 by 24 inches.

9. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

D. Basis-of-Design Product: Armstrong World Industries, Inc; Fine Fissured Square Lay-in tiles.
1. Classification: Provide fire-resistance-rated panels complying with ASTM E 1264 for type, form, and pattern as follows:
   a. Type and Form: Type and Form: Type III, mineral base with painted Finish; Form 2, water felted.
   b. Pattern: G (smooth).
2. Color: White.
3. LR: Not less than 0.55.
4. CAC: Not less than 33.
5. Edge/Joint Detail: Square.
6. Thickness: 5/8 inch.
7. Modular Size: 24 by 24 inches.
8. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEM

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. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
1. Structural Classification: Intermediate -duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel or aluminum.
5. Cap Finish: Painted white.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down.

2.6 METAL EDGE MOLDINGS AND TRIM

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. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.

4. Fry Reglet Corporation.
5. Gordon, Inc.
6. United States Gypsum Company.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to

permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
   2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. As indicated on reflected ceiling plans.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
   3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
   4. Install hold-down clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
      a. Hold-Down Clips: Space 24 inches (610 mm) o.c. on all cross runners.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Thermoset-rubber base.
2. Rubber molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Coordinate mockups in this Section with mockups specified in other Sections.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

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. Burke Mercer Flooring Products; a division of Burke Industries Inc.
2. Flexco.
3. Johnsonite; a Tarkett company.

4. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
1. Style and Location:
a. Style A, Straight: Provide in areas with carpet.
b. Style B, Cove: Provide in areas with resilient floor coverings.

C. Thickness: 0.125 inch (3.2 mm).

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As scheduled.

2.2 RUBBER MOLDING ACCESSORY

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. Roppe Corporation, USA.
2. VPI Corporation.

B. Profile and Dimensions: As indicated.

C. Locations: Provide rubber molding accessories in areas indicated.

D. Colors and Patterns: As Scheduled.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
      a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

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SECTION 09 6519

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid vinyl floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.
   1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Coordinate mockups in this Section with mockups specified in other Sections.
      a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C)or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C)or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 SOLID VINYL FLOOR TILE

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. Altro Group.
2. American Biltrite.
3. Armstrong World Industries, Inc.
4. Congoleum Corporation.
5. Ecomoso, Centiva Vinyl Flooring.
6. Gerflor.
7. IVC US.
8. Johnsonite; a Tarkett company.
9. Mannington Mills, Inc.
10. Patcraft; a division of Shaw Industries, Inc.
11. Philadelphia Commercial; a division of Shaw Industries, Inc.
12. Polyflor, Ltd.; distributed by Gerbert Limited.
13. Shaw Contract Group; a Berkshire Hathaway company.
14. TOLI International.
15. VPI Corporation.

B. Tile Standard: ASTM F 1700.
1. Class: Class III, Printed Film Vinyl Tile.
2. Type: B, Embossed Surface.

C. Thickness: As scheduled.

D. Size: 9 by 36 inches.

E. Colors and Patterns: As scheduled.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)in 24 hours.
   b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION

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SECTION 09 6566

RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rubber sheet flooring.

1.2 COORDINATION

A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details and locations of the following:
1. Border tiles.
2. Floor patterns.
3. Layout, colors, widths, and dimensions of game lines and markers.
4. Locations of floor inserts for athletic equipment installed through flooring.
5. Seam locations for sheet flooring.

C. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch- (150-mm-) square in size and of same thickness and material indicated for the Work.
1. Game-Line- and Marker-Paint Samples: Include Sample sets showing game-line- and marker-paint colors applied to flooring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sheet Flooring: Furnish full-width rolls of not less than 10 linear feet (3 linear m) for each 500 linear feet (150 linear m) or fraction thereof, of each type, color, and pattern of flooring installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration.
1. Store rolls upright.

1.7 FIELD CONDITIONS

A. Adhesively Applied Products:
1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RUBBER SHEET FLOORING

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. Aacer Flooring, LLC.
2. Action Floor Systems, LLC.
3. Amarco Products.
4. American Floor Products Company, Inc.
5. Conner Sports Surface Solutions.
6. Flexco.
7. Horner Flooring Company, Inc.
8. Johnsonite; a Tarkett company.
9. Mateflex.
10. Mondo America Inc.
11. Nora Systems, Inc.
12. Regupol America.
13. Robbins Sports Surfaces.
14. Roppe Corporation, USA.
15. Sport Court.
16. Surface America Incorporated.
17. Tarkett Sports; a division of the Tarkett Group.

B. Basis-of-Design Product: Mondo America Inc; Sportflex Super X 720 K35.

C. Description: Rubber athletic flooring provided as rolled goods for adhered installation.

D. Material: Rubber wear layer and rubber shock-absorbent layer, vulcanized together.

E. Traffic-Surface Texture: Embossed.

F. Roll Size: Not less than 48 inches (1219 mm) wide by longest length that is practical to minimize splicing during installation.

G. Thickness: 0.413 inches (10.5 mm).

H. Color and Pattern: As scheduled.

2.2 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

C. Game-Line and Marker Paint: Complete system including primer, if any, compatible with flooring and recommended in writing by flooring and paint manufacturers for use indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.

3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
   b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
   1. Do not install flooring until it is the same temperature as space where it is to be installed.

F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.4 SHEET FLOORING INSTALLATION

A. Unroll sheet flooring and allow it to stabilize before cutting and fitting.

B. Lay out sheet flooring as follows:
   1. Maintain uniformity of flooring direction.
   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (150 mm) away from parallel joints in flooring substrates.
   3. Match edges of flooring for color shading at seams.
   4. Locate seams according to approved Shop Drawings.

C. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
   1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 GAME LINES AND MARKERS

A. Mask flooring at game lines and markers, and apply paint to produce sharp edges. Where crossing, break minor game line at intersection; do not overlap lines.

B. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.

3.6 FIELD-APPLIED FINISHES

A. Apply finish after game-line and marker paint is fully cured.

B. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.

C. Do not cover flooring after finishing until finish reaches full cure.

3.7 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing flooring installation:
   1. Remove adhesive and other blemishes from flooring surfaces.

2. Sweep and vacuum flooring thoroughly.
3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION

SECTION 09 6623

RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Precast epoxy-resin terrazzo units.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to terrazzo including, but not limited to, the following:
a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
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 special terrazzo designs and patterns.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:
1. Accessory strips.
2. Stair treads, risers, and landings.
3. Precast terrazzo jointing and edge configurations.
4. Terrazzo patterns.

C. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:
1. Precast Terrazzo: 6-inch- (150-mm-) square Samples.
2. Accessories: 6-inch- (150-mm-) long Samples of each exposed strip item required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each type of terrazzo material or product.

C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

D. Preinstallation moisture-testing reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Engage an installer who is a contractor member of NTMA.
2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups for terrazzo including accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

B. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3 PRECAST EPOXY-RESIN TERRAZZO

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. Precast Terrazzo Enterprises, Inc.
2. Romoco Precast Terrazzo Products; a subsidiary of Roman Mosaic & Tile Company.
3. Wausau Tile Inc.

B. Precast Terrazzo Units: Minimum 3/4-inch (19-mm) thick, epoxy terrazzo units. Comply with manufacturer's written instructions for fabricating precast units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to 1/8-inch (3.2-mm) radius.
1. Color, Pattern, and Finish: As scheduled.

2.4 STRIP MATERIALS

A. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
1. Base-bead strips for exposed top edge of terrazzo base.
2. Edge-bead strips for exposed edges of terrazzo.

2.5 MISCELLANEOUS ACCESSORIES

A. Anchoring Devices:
1. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

B. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

C. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

D. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; and is recommended by sealer manufacturer.
1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas, 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, including levelness tolerances, have been corrected.

3.2 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:
1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written instructions.
c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

D. Preinstallation Moisture Testing:
1. Testing Agency: Engage a qualified testing agency to perform tests.
2. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
a. Moisture-Vapor-Emission Test: Maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours when tested according to ASTM F 1869 using anhydrous calcium chloride.
b. Relative Humidity Test: Maximum 75 percent relative humidity measurement when tested according to ASTM F 2170 using in-situ probes.
3. Proceed with terrazzo installation only after concrete substrates pass moisture testing or after installation of moisture-vapor-emission-control membrane on substrate areas that fail testing.

E. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.
1. Install on concrete substrates that incorporate lightweight aggregates.
2. Install concrete substrates that fail preinstallation moisture testing.

F. Substrate-Crack-Suppression Membrane: Install to isolate and suppress substrate cracks according to manufacturer's written instructions.
1. Prepare and prefill substrate cracks with membrane material.
2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
3. Reinforce membrane with fiberglass scrim.

G. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.
1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 PRECAST TERRAZZO INSTALLATION

A. Install precast terrazzo units using method recommended in writing by NTMA and manufacturer unless otherwise indicated.

B. Do not install units that are chipped, cracked, discolored, or improperly finished.

C. Seal joints between units with joint compound matching precast terrazzo matrix.

3.4 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.5 CLEANING AND PROTECTION

A. Cleaning:
   1. Remove grinding dust from installation and adjacent areas.
   2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:
   1. Seal surfaces according to NTMA's written recommendations.
   2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09 6813

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of edge, transition, and other accessory strips.
   9. Transition details to other flooring materials.

C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

1.7 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, the following:
      a. More than 10 percent edge raveling, snags, and runs.
      b. Dimensional instability.
      c. Excess static discharge.
      d. Loss of tuft-bind strength.
      e. Loss of face fiber.
      f. Delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. As scheduled.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
   1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
      c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

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SECTION 09 7200

WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vinyl wall covering.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.

C. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36-inch- (914-mm-) long in size.
1. Wall-Covering Sample: From same production run to be used for the Work, with specified treatments applied. Show complete pattern repeat.

D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for installation.
1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141 for appearance shading characteristics.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.
2. Fire-Growth Contribution: No flashover and heat and smoke release according to NFPA 265.

2.2 VINYL WALL COVERING

A. As scheduled.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 09 9123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
   1. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
   2. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 WALL-COVERING INSTALLATION

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.
   1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip or as recommended by wall covering manufacturer.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern as recommended by wall covering manufacturer above the finish floor.

F. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 3 inches (75 mm) from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

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SECTION 09 8116

ACOUSTICAL BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Concealed building insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

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. Glass-Fiber Insulation:
      a. CertainTeed Corporation.
      b. Johns Manville Corporation.
      c. Owens Corning.
   2. Slag-Wool-/Rock-Wool-Fiber Insulation:
      a. Fibrex Insulations Inc.
      b. Owens Corning.
      c. Thermafiber.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.
   1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Unfaced Mineral-Fiber Blanket Insulation (in walls): ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Unfaced, Flexible Glass-Fiber Blanket Insulation (above ceilings): ASTM C 612, Type IA; ASTM C 553, Types I, II, and III; or ASTM C 665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
   1. Nominal density of 1.0 lb/cu. ft., thermal resistivity of 3.7 deg F x h x sq. ft./Btu x in. at 75 deg F.
   2. Nominal density of not less than 1.5 lb/cu. ft. nor more than 1.7 lb/cu. ft., thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
   3. Combustion Characteristics: Passes ASTM E 136.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.5 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 09 8433

SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
   1. Sound-absorbing wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For unit assembly and installation.
   1. Include plans, elevations, sections, and mounting devices and details.
   2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
   3. Include details at cutouts and penetrations for other work.

C. Samples for Verification: For the following products:
   1. Panel Edge: 12-inch- (300-mm-) long Sample(s) showing each edge profile, corner, and finish.
   2. Core Material: 12-inch- (300-mm-) square Sample at corner.
   3. Mounting Devices: Full-size Samples.
   4. Assembled Panels: Approximately 36 by 36 inches (900 by 900 mm), including joints and mounting methods.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Electrical outlets, switches, and thermostats.
   2. Items penetrating or covered by units including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Alarms.
      e. Sprinklers.
      f. Access panels.
   3. Show operation of hinged and sliding components covered by or adjacent to units.

B. Product Certificates: For each type of unit.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.
   1. Build mockup of typical wall area as directed by Architect.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install units until a lighting level of not less than 50 fc (538 lx) is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to the following:
a. Acoustical performance.
b. Warping of core.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 SOUND-ABSORBING WALL UNITS

A. Sound-Absorbing Wall Panel: Manufacturer's standard monolithic panel construction consisting of 100 percent recycled thermally bonded high density polyester.

B. Basis-of-Design Product: Autex Acoustics; Cube.
1. Panel Shape: Flat.
2. Mounting: Back mounted with manufacturer's standard adhesive, secured to substrate.
3. Dimensions: Panel 48 inches by 8 feet (1220 mm by 2440 mm).
4. Thickness: 0.47 inch (12 mm) and 0.94 inch (24mm)
5.
6. Nominal Overall Panel Thickness: 1/2 inch (25 mm).
a. Sound Absorption: Class D, NRC 0.45
7. Nominal Overall Panel Thickness:1 inch (24 mm).
a. Sound Absorption: Class D, NRC 0.65.

8. Panel Width: 48 inches (1220 mm).
9. Panel Height: 96 inches (2438 mm).

2.4 MATERIALS

A. Panel Materials: 100 percent recycled thermally bonded high-density polyester (100 percent PET) containing not less than 65 percent post-consumer recycled material.

2.5 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated.

B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:
1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm) in 48 inches (1200 mm), noncumulative.

B. Variation of Joint Width: Not more than 1/16-inch (1.6-mm) variation from hairline in 48 inches (1200 mm), noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION

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SECTION 09 9123

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
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.

B. Colors: As scheduled.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Masonry (Clay and CMUs): 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Wood Substrates:
1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

A. General:
1. Remove cracked and deteriorated sealants and calking.
2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.
3. Wash surfaces with solution of TSP to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.
4. Abrade glossy surfaces by sanding or wiping with liquid de-glosser.
5. Remove mildew as specified above.
6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, request recommendation from Architect.
7. Apply specified primer to surfaces scheduled to receive coatings.

B. Gypsum Wallboard:
1. Fill cracks and voids with spackling compound.
2. Apply primer over bare surfaces and newly applied texture coatings.

C. Metal:
1. Remove rust from surfaces to bare metal in accordance with SP3 "Power Tool Cleaning".
2. Exercise care not to remove galvanizing.
3. Complete preparation as specified for new work.

D. Wood:
1. Fill cracks, crevices and nail holes with putty or wood filler.
2. Apply primer over bare surfaces and filler material.

3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in equipment rooms:
      a. Equipment, including panelboards and switch gear.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Tanks that do not have factory-applied final finishes.
      h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   2. Paint the following work where exposed in occupied spaces:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      h. Other items as directed by Architect.
   3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

F. Rated Wall Assemblies Identification:
   1. Identify fire-rated wall assemblies with stenciled lettering on wall surface above ceiling line.
   2. Provide stenciled block letters in red to identify each rated wall assembly.
   3. Refer to Section 09 2900 "Gypsum Board" and Life Safety Legend on Code Compliance Plan.

3.5 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 INTERIOR PAINTING SCHEDULE

A. Gypsum Board, Semi-Gloss, Low Odor: 2 finish coats over a primer.
   1. Sherwin-Williams:
      a. Primer: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
      b. Second Coat: PorMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series 1.6 mils DFT.
      c. Third Coat: Same as second coat.

B. Gypsum Board, Eggshell, Low Odor: 2 finish coats over a primer.
   1. Sherwin-Williams:
      a. Primer: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
      b. Second Coat: PorMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series 1.7 mils DFT.
      c. Third Coat: Same as second coat.

C. Woodwork and Hardboard, Low-Luster (eggshell or satin), Acrylic Enamel Finish: Two finish coats over a primer.
   1. Sherwin-Williams:
      a. Primer: Premium Wall & Wood Latex Primer, B28W8111 1.6 mils DFT.
      b. Second Coat: PorMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series 1.7 mils DFT.
      c. Third Coat: Same as second coat.

D. Ferrous Metal, Eggshell, Acrylic-Enamel Finish: Two finish coats over a primer.
   1. Sherwin-Williams:
      a. Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series 2.0 - 4.0 mils DFT.
      b. Second Coat: Pro Industrial Acrylic Eg-Shel, B66-660 Series 2.5 mils DFT.
      c. Third Coat: Same as second coat.

E. Ferrous Metal, Epoxy, Semi-Gloss, Low VOC: 2 finish coats over a primer. Wherever wall surfaces are scheduled to receive epoxy paint, paint doors and frames within the wall with epoxy.
   1. Sherwin-Williams:
      a. Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series 2.0 - 4.0 mils DFT.
      b. Second Coat: Water Based Catalyzed Epoxy, B70-200 Series, 3.0 mils DFT.
      c. Third Coat: Same as second coat.

F. Concrete Masonry Units, Epoxy, Semi-Gloss:
   1. Sherwin-Williams:
      a. Primer: PrepRite Block Filler, B25W25 8 mils DFT
      b. Second Coat: SW Dura-Plate 235 Multi-Purpose Epoxy, B67-235 Series 5 mils.
      c. Third Coat: Same as second coat.

END OF SECTION

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SECTION 09 9300

STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of wood stains and transparent finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Verification: For each type of finish system and in each color and gloss of finish required.
   1. Submit Samples on representative samples of actual wood substrates, 8 inches (200 mm) square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of stain color selections will be based on mockups.
      a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

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. Behr Process Corporation.
2. PPG Architectural Coatings.
3. Sherwin-Williams Company (The).

2.2 MATERIALS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. Stain Colors: As scheduled.

2.3 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.
1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
   1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
   2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
   3. Sand surfaces exposed to view and dust off.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.
   5. Previously Painted Surfaces: Remove previous paint coating and sand to bare wood as recommended by coating manufacturer.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
   1. Use applicators and techniques suited for finish and substrate indicated.
   2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
   3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

A. Wood Substrates:.
   1. Lacquer over Stain System:
      a. Stain Coat: Stain, semitransparent, for interior wood.
      b. First Intermediate Coat: Lacquer matching topcoat.
      c. Second Intermediate Coat: Lacquer matching topcoat.
      d. Topcoat: Lacquer as selected by Architect to match existing finishes.

B. Wood Doors (Previously Painted):
   1. Water-Based Varnish over Stain System:
      a. Stain Coat: Sherwin Williams SHER-WOOD Wiping Stains.
      b. Intermediate Coat: Sherwin Williams SHER-WOOD Vinyl Sealer 24% Solids.
      c. Topcoat: Sherwin Williams SHER-WOOD Water White Conversion Varnish.

END OF SECTION

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SECTION 09 9600

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems.

1.2 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
      a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Sherwin-Williams Company (The).
2. Tnemec Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
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.
3. Products shall be of same manufacturer for each coat in a coating system.

C. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 100 g/L.
4. Rust-Preventive Coatings: 100 g/L.
5. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
6. Pretreatment Wash Primers: 420 g/L.

D. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Colors: As scheduled.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Masonry (Clay and CMUs): 12 percent.
   2. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
   1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi (690 to 4140 kPa) at 6 to 12 inches (150 to 300 mm).

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
   1. Use applicators and techniques suited for coating and substrate indicated.
   2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
   1. Contractor shall touch up and restore coated surfaces damaged by testing.
   2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Galvanized-Metal Substrates:
   1. Pigmented Polyurethane over Epoxy Zinc-Rich Primer System:
      a. Prime Coat: Primer, zinc rich, epoxy.
      b. Intermediate Coat: Epoxy, gloss.
      c. Topcoat: Polyurethane, two component, pigmented, gloss.

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. CMU Substrates:
   1. Polysiloxane System:
      a. Preparation: Prepare previously coated surface as recommended by coating manufacturer.
      b. Finish Coat: Sherwin Williams Sher-Loxane 800 two component polysiloxane 5 mils.

B. Gypsum Board Substrates:
   1. Polysiloxane System:
      a. Preparation: Prepare previously coated surface as recommended by coating manufacturer.
      b. Finish Coat: Sherwin Williams Sher-Loxane 800 two component polysiloxane 5 mils.

END OF SECTION

SECTION 10 1400

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Identifying devices where shown on the Drawings complete and as specified including the following:
a. Parking signs indicating accessible spaces.
b. Interior code required signs.

1.2 SUBMITTALS

A. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

B. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, accessories, layout, and installation details.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

B. Manufacturer shall have a minimum of five years experience in the manufacturing of signs specified.

C. Codes and Standards:
1. Panel signs shall have 1/32-inch raised copy and grade 2 Braille, and shall comply with all existing federal, state, and local accessibility standards.
2. Code and Standards: Comply with American with Disabilities Act of 1990, Title 3 Provisions, Public Accommodations and Commercial Facilities. Updated March 15, 2012.
3. Comply with the State of Texas Accessibility Standards, 2012 edition, as administered by the Texas Department of Licensing and Regulation.

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. Best Sign Systems, Montrose, Colorado.
2. Mohawk Sign Systems, Schenectady, New York.
3. Nelson-Harkins, Chicago, Illinois.
4. ASI Signs, Dallas, Texas.

2.2 HANDICAPPED PARKING

A. Screen Printed Signs:
1. 18 gage bonderized steel with blue baked enamel finish and white screen printed copy.
2. Copy and Size:
a. "Handicapped Parking Only" – 12 inches by 18 inches.
b. "Van Accessible" – 12 inches by 6 inches.
3. Acceptable Product: Best Traffic Signs No. SS04 with SS52 as required.

B. Post: Galvanized pipe column minimum 9 feet long.

2.3 ROOM SIGNAGE SYSTEMS

A. Basis-of-Design Product: ASI Unframed SP Series Signs with requirements indicated for materials, thickness, finish colors, designs, shapes, sizes and details.

B. Sign Face: Clear acrylic, 0.080-inch thick, matte first surface.
1. Adhesive: Pressure sensitive adhesive film, second surface.

C. Tactile Graphics and Text:
   1. Fabrication: Provide tactile copy and grade 2 Braille raised 1/32 inch minimum from plaque first surface by manufacturer's stratification process as follows:
      a. Basis-of-Design Product: ASI Intouch, photo-mechanical method.
   2. Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant ADA regulations and requirements indicated for size, style, spacing, content, position, and colors.

D. Non-Tactile Graphics and Text:
   1. Fabrication options:
      a. Basis-of-Design Product: ASI; Series SPE/SPJ: Non-tactile graphic plaque, no back plate.
   2. Text or graphic technique:
      a. Screen process using subsurface method.
   3. Provide lettering and graphics precisely formed, uniformly opaque, and consistent in size, style, spacing, content, position, and colors.

E. Overall Panel Size: Refer to Drawings.

F. Panel Colors: As selected by Architect.

G. Text or Graphic Colors: As selected by Architect.

H. Letter styles, colors, letter sizes and layout position: As selected by Architect.

I. Installation Method: System SA, silicone adhesive.

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

A. Deliver and store identifying devices in protective wrappings until ready for installation. Install letters in protective wrappings and remove wrappings just prior to substantial completion.

3.2 INSTALLATION

A. Install signs plumb, level and square and in proper planes with other work, at heights required by accessibility codes and standards.

B. Anchor each plastic laminate sign with adhesive.

C. Install signs with sufficient amount of foam tape for proper installation.

D. Attach as recommended by sign manufacturer.

E. Anchor each sign with adhesive.

F. Coordinate arrival and installation of graphic signs with hardware installation. Graphic signs function as and are coordinated with the hardware as shown on the Drawings.

G. Room name signs shall be placed on the public side of the door except where noted otherwise.

H. Single Door Sign: Provide one sign as specified above, mounted to wall adjacent to door on knob side.

I. Pair of Doors: Provide one sign as specified above, mounted to adjacent wall closest to active leaf of door. Do not install sign where it will be obstructed by door when door is in the 'open' position.

J. Attachment: Mounting to surfaces shall be done by pressure sensitive frame double-faced tape. Signs shall be delivered to the project site with the tape in place and trimmed on each sign, but with the protective paper layer not removed. Paper layer shall be removed just prior to installation of signs.

3.3 EXTERIOR INSTALLATION - PARKING SIGNS

A. Mount posts in 12-inch round by 2'-6" deep concrete footing.

B. Handicapped Signs: Mount signs at height to comply with accessibility codes.

3.4 COORDINATION

A. Coordinate the installation of the identifying devices with the hardware manufacturer for lockset and knob leave outs as detailed and scheduled.

3.5 DAMAGE

A. Any identifying device which is scratched or defaced will be rejected.

3.6 CLEANING

A. Remove protective materials and clean all signs. Clean surfaces with plain water or water with soap or household detergent.

END OF SECTION

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SECTION 10 1419

DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fabricated channel dimensional characters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.
1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
1. Dimensional Characters: Full-size Sample of each type of dimensional character.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

E. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.
1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design sign structure and anchorage of dimensional character sign type(s) according to structural performance requirements.

B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
1. Uniform Wind Load: As indicated on Drawings.
2. Concentrated Horizontal Load: As indicated on Drawings.

3. Other Design Load: As indicated on Drawings
4. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 DIMENSIONAL CHARACTERS

A. Fabricated Channel Characters: Metal face and side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.
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.R.K. Ramos.
b. APCO Graphics, Inc.
c. ASI Sign Systems, Inc.
d. Diskey Architectural Signage Inc.
e. Gemini Incorporated.
f. Southwell Company (The).
2. Character Material: Sheet or plate aluminum.
3. Material Thickness: Manufacturer's standard for size and design of character.
4. Character Height: As indicated on Drawings.
5. Character Depth: As indicated on Drawings.
6. Finishes:
a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
7. Mounting: As indicated on Drawings.
a. Hold characters at manufacturer's recommended distance from wall surface.
8. Typeface: As indicated on Drawings.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:
a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
b. Fastener Heads: For nonstructural connections, use flathead screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
4. Sign Mounting Fasteners:
a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color color unless otherwise indicated.
2. Stainless-Steel Brackets: Factory finish brackets Insert finish finish unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 2600

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Corner guards.
2. End-wall guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.
1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
1. Corner and End-Wall Guards: 12 inches (300 mm) long. Include example top caps.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of exposed plastic material.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch- (1200-mm-) long units.
2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.6 QUALITY ASSURANCE

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
a. Store corner-guard covers in a vertical position.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in and.

2.3 CORNER GUARDS

A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard, PVC-free assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Arden Architectural Specialties, Inc.
b. Balco, Inc.
c. Construction Specialties, Inc.
d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
e. Korogard Wall Protection Systems; a division of RJF International Corporation.
f. Pawling Corporation.
2. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; as follows:
a. Profile: Nominal 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius.
b. Height: 8 feet (2.4 m).
c. Color and Texture: As selected by Architect from manufacturer's full range.
3. Continuous Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum**-**.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 END-WALL GUARDS

A. Surface-Mounted, Plastic-Cover, End-Wall Guard: Manufacturer's standard, PVC-free assembly consisting of snap-on, resilient plastic cover installed over continuous retainer; including mounting hardware.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Arden Architectural Specialties, Inc.
b. Balco, Inc.
c. Construction Specialties, Inc.
d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
e. Korogard Wall Protection Systems; a division of RJF International Corporation.
f. Pawling Corporation.
2. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; as follows:
a. Profile: Nominal 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius.
b. Height: 8 feet (2.4 m).
c. Color and Texture: As selected by Architect from manufacturer's full range.
3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.5 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

D. Adhesive: As recommended by protection product manufacturer.

2.6 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.7 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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 walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
   1. Provide anchoring devices and suitable locations to withstand imposed loads.
   2. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm) apart.
   3. Adjust top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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SECTION 10 2800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Childcare accessories.
4. Underlavatory guards.
5. Custodial accessories.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified 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 PUBLIC-USE WASHROOM ACCESSORIES

A. Combination Toilet Tissue Dispenser:
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. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product:
a. Recessed: Bobrick Washroom Equipment, Inc.; B-3092.
3. Description: Combination unit with double-roll toilet tissue dispenser and the following:
a. Removable sanitary-napkin waste receptacle with self-closing, disposal-opening cover.
b. Seat-cover dispenser with minimum capacity of 500 single or half-fold seat covers.

4. Toilet Tissue Dispenser Capacity: 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
5. Toilet Tissue Dispenser Operation: Noncontrol delivery with theft-resistant spindles.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Lockset: Tumbler type.

B. Waste Receptacle:
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. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-43644.
3. Mounting: Open top, recessed.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Liner: Reusable vinyl liner.
6. Lockset: Tumbler type for waste receptacle.

C. Combination Towel (Folded) Dispenser/Waste Receptacle:
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. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-3944.
3. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
4. Mounting: Recessed.
   a. Designed for nominal 4-inch (100-mm) wall depth.
5. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
6. Minimum Waste-Receptacle Capacity: 12 gal. (45.4 L).
7. Material and Finish: Stainless steel, No. 4 finish (satin).
8. Liner: Reusable, vinyl waste-receptacle liner.
9. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.

D. Automatic Liquid-Soap Dispenser:
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. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-2013.
3. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing antibacterial soap in lather form.
4. Mounting: Wall mounted.
5. Materials: Stainless steel, No. 4 finish (satin)
6. Refill Indicator: LED indicator.
7. Low Battery Indicator: LED indicator.

E. Automatic Liquid-Soap Dispenser:
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. Kohler Co..
2. Basis-of-Design Product: Kohler Co.; Compressed, Touchless Foaming Soap Dispenser.
3. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing antibacterial soap in lather form.
4. Mounting: Deck mounted on vanity.
5. Materials: Polished chrome
6. Refill Indicator: LED indicator.
7. Low Battery Indicator: LED indicator.

F. Grab Bar:
1. Manufacturers: Subject to compliance with requirements,:
   a. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-5806.
3. Mounting: Flanges with concealed fasteners.
4. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
   a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
5. Outside Diameter: 1-1/4 inches (32 mm).
6. Configuration and Length: As indicated on Drawings.

G. Vendor:
1. Manufacturers: Subject to compliance with requirements,:
   a. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-47064 25.
3. Type: Sanitary napkin and tampon.
4. Mounting: Semirecessed.
5. Operation: Single coin (25 cents).
6. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
7. Lockset: Tumbler type with separate lock and key for coin box.

H. Mirror Unit:
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. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product:
   a. Full Height Mirror: Bobrick Washroom Equipment, Inc.; B-165 2460.
   b. LED Backlit Mirror: Bobrick Washroom Equipment, Inc.; B-167.
3. Frame: Stainless-steel channel.
   a. Corners: Manufacturer's standard.
4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
   b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
5. Size: As indicated on Drawings.

2.2 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Shower Curtain Rod:
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. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-6047.
3. Description: 1-1/4-inch (32-mm) OD; fabricated from nominal 0.05-inch- (1.3-mm-) thick stainless steel.
   a. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
   b. Finish: Stainless steel, No. 4 finish (satin).

B. Shower Curtain:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Bobrick Washroom Equipment
2. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; 204-2.
3. Size: Minimum42 inches wid by 72 inches (1828 mm) high.
4. Material: 0.008-inch- (0.2-mm-) thick vinyl, with integral antibacterial agent.
5. Color: White.
6. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
7. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

C. Folding Shower Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Teak Works 4 U.
2. Basis-of-Design Products:
   a. ADA Wall Mount Shower Seat: Teak Works 4 U; TBF-180160W.
      1) Width: 18 inches.
   b. ADA Wall Mount Shower Seat: Teak Works 4 U; TBF-300160W.
      1) Width: 30 inches.
   c. ADA Folding Transfer Bench with Legs: Teak Works 4 U; TBF2-360160W.
      1) Width: 36 inches.
3. Configuration: Rectangular seat.
4. Seat: Manufacturer’s standard.
5. Mounting Mechanism: Stainless steel, No. 4 finish (satin).

D. Robe Hook:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Bobrick Washroom Equipment, Inc.
2. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-76727.
3. Description: Double -prong unit.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

2.3 PRIVATE-USE BATHROOM ACCESSORIES

A. Wall Shelf:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Schluter Systems.
2. Basis-of-Design Product: Schluter Systems; KERDI-BOARD-SIN.
3. Material and Finish: Manufacturer's standard to receive schedule tile finish.

2.4 CHILDCARE ACCESSORIES

A. Diaper-Changing Station:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Koala Kare Products; a division of Bobrick.
2. Basis-of-Design Product: Koala Kare Products; KB310-SSWM.
3. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
a. Engineered to support minimum of 250-lb (113-kg) static load when opened.
4. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
5. Operation: By pneumatic shock-absorbing mechanism.
6. Material and Finish: Stainless steel, No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.
7. Liner Dispenser: Built in.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Plumberex Specialty Products, Inc.
b. Truebro by IPS Corporation.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

A. Mop and Broom Holder:
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. Bobrick Washroom Equipment, Inc.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches (914 mm).
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.7 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

D. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

E. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.8 FABRICATION

A. General: 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION

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SECTION 10 4413

FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire-protection cabinets for the following:
a. Portable fire extinguisher.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semirecessed -mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.
1. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire-protection cabinets. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Potter Roemer LLC.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

B. Cabinet Construction: Nonrated and rated to match adjacent wall construction.
1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Stainless-steel sheet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Stainless-steel sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide projecting door pull and friction latch.
   2. Provide continuous hinge, of same material and finish as trim,, permitting door to open 180 degrees.

J. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
   3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.
         2) Application Process: Pressure-sensitive vinyl letters.
         3) Lettering Color: Red.
         4) Orientation: Vertical.

K. Materials:
   1. Stainless Steel: ASTM A 666, Type 304.
      a. Finish: No. 4 directional satin finish,.
   2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Miter corners and grind smooth.
   3. Provide factory-drilled mounting holes.
   4. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
   2. Fabricate door frames of one-piece construction with edges flanged.
   3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. 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 walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:
   1. Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 10 4416

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the Work include, but are not limited to, the following:
      a. Babcock-Davis.
      b. Amerex Corporation.
      c. Brooks Equipment Co., Inc.
      d. Buckeye Fire Equipment Co.
      e. Fire-End & Croker Corporation.
   2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
   3. Valves: Manufacturer's standard.
   4. Handles and Levers: Manufacturer's standard.
   5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A:40-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION

SECTION 10 5116

WOOD LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wood-faced wood lockers and benches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wood locker and bench.

B. Shop Drawings: For wood lockers.
   1. Include plans, elevations, sections, and attachment details.
   2. Show details full size.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in lockers.
   5. Show locker fillers, trim, base, sloping tops, and accessories.
   6. Show locker identification system and numbering sequence.

C. Samples for Verification: For the following products:
   1. Wood-faced panels with transparent finish, not less than 8 by 10 inches (203 by 254 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
   2. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wood locker doors, complete with specified door hardware. Furnish no fewer than five doors of each type and color installed.
   2. Units of the following locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
      a. Hinges.
      b. Pulls.
      c. Shelf rests.
      d. Cylinder locks.
      e. Blank identification plates and holders.
      f. Hooks.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical corner, including one locker on each side of corner and corner filler , including door panel with specified door hardware, as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wood lockers until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
   1. Locate concealed framing, blocking, and reinforcements that support lockers by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where wood lockers are indicated to fit to other construction, establish dimensions for areas where lockers are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of concealed wood support bases.
   1. Requirements are specified in Section 06 1053 "Miscellaneous Rough Carpentry."

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that wood lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of locks and other hardware.
      c. Deterioration of wood, wood finishes, and other materials beyond normal use.
   2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and Texas Accessibility Standards (TAS).

2.2 WOOD-FACED WOOD LOCKERS

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. Hollman, Inc.

B. Construction Style: As indicated.
   1. Reveal Dimension: As indicated .

C. Final Assembly: Manufacturer's standard factory assembly.

D. Locker Body: Fabricated from particleboard -core panels covered on both sides with thermoset decorative overlay.
   1. Side Panels: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
   2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch (13 or 9.5 mm) thick.
   3. Top Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
   4. Bottom Panel: Manufacturer's standard 3/4 or 5/8 inch (19 or 16 mm) thick.
   5. Exposed Panel Edges: Solid wood to match doors.

E. Raised-Panel, Wood-Faced Doors: Stiles, rails, and center panel fabricated from 3/4-inch- (19-mm-) thick, wood-faced, medium-density fiberboard.
   1. Wood Veneer: As selected by Architect from manufacturer's full range.

F. End Panels: Match style, material, construction, and finish of wood-faced wood doors.

G. Shelves: Fabricated from particleboard -core panels covered on both sides with thermoset decorative overlay; fixed.
   1. Thickness: 3/4 inch (19 mm).
   2. Exposed Edges: Solid wood to match doors.

H. Corners and Filler Panels: 3/4-inch- (19-mm-) thick panel. Match style, material, construction, and finish of wood-faced wood doors.

I. Continuous Finish Base: Wood-faced, 3/4-inch- (19-mm-) thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of lockers.

J. Veneer Matching:
   1. Provide veneers for each door from a single flitch, book and running matched.

K. Transparent Finish: Manufacturer's standard two-coat, clear, catalyzed lacquer finish with sanding between coats. Seal with moisture-resistant topcoat.
   1. Stain: Match approved sample for color.

L. Factory finish wood lockers as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
   1. Preparations for Finishing: Sand, fill countersunk fasteners, seal concealed surfaces, and perform similar preparations for finishing lockers, as applicable to each unit of the Work.
   2. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood lockers that do not have finish materials applied. Apply two coats to concealed backs and ends of panels.

2.3 MATERIALS

A. Solid Wood: Clear hardwood lumber, selected for compatible grain and color.

B. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
   2. Softwood Plywood: DOC PS 1.
   3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

C. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

D. Anchors: Material, type, size, and finish as 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.

E. Wood Support Base: 2-by-4-inch nominal-size (51-by-102-mm actual-size) lumber treated with manufacturer's standard preservative-treatment, pressure process.

2.4 HARDWARE

A. Cylinder Lock: Built-in, flush cam locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and two master keys.
   1. Key Type: Flat.
   2. Bolt Operation: Manually locking deadbolt.

B. Frameless Hinges (European Type): Fully concealed, self-closing, nickel-plated steel, with not less than 125 degrees of opening.
   1. Provide two hinges for doors 36 inches (914 mm) high and less.
   2. Provide three hinges for doors more than 36 inches (914 mm) high.

C. Wire Pulls: Back mounted; 4 inches (1020 mm) long, 5/16 inch (8 mm) in diameter.

D. Accessible Handle: Metal, fixed, graspable lever handle and rose trim; surface mounted.

E. Shelf Rests: BHMA A156.9, B04013.

F. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; finished to match other locker hardware. Attach hooks with at least two fasteners.
1. Provide hooks as indicated on Drawings.

G. Exposed Hardware Finish: Satin chrome unless otherwise indicated.

2.5 ACCESSORIES

A. Number Identification Plates: 1-1/2-inch- (38-mm-) diameter, etched, embossed, or stamped, stainless-steel plates with black numbers and letters at least 1/2 inch (13 mm) high. Identify lockers in sequence indicated on Drawings. Finish plates to match other wood locker hardware.

2.6 BENCHES

A. End-Panel Locker Benches: Bench top supported between vertical end supports, as follows:
1. End Supports: 4-inch (102-mm) thickness, with height and width same as height and width of bench.
a. Finish: Match style, material, and finish of locker doors.
2. Bench Top: 3-inch- (76-mm-) thick, particleboard core. Provide 1/2-inch- (13-mm-) radius top edges on bench sides.
a. Width: As indicated.
b. Height: As indicated.
c. Length: As indicated.
d. Finish: Match style, material, and finish of locker doors.

2.7 FABRICATION

A. Fabricate each locker with shelves, an individual door and frame, an individual top, a bottom, and a back, and with common intermediate uprights separating compartments.
1. Fabricate lockers to dimensions, profiles, and details indicated.
2. Ease edges of corners of solid-wood members to 1/16-inch (1.5-mm) radius.

B. Fabricate lockers square, rigid, without warp, and with finished faces flat and free of dents, scratches, and chips. Accurately factory machine components for attachments. Make joints tight and true.
1. Fabricate lockers using manufacturer's standard construction, with joints made with dowels, dados, or rabbets. Dado side panels to receive shelving except where indicated to be adjustable.

C. Accessible Lockers: Fabricate as follows:
1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

D. Venting: Fabricate lockers with space between doors and locker assembly of not less than 1/4 inch (6 mm).

E. Number Identification Plates: Inlay number plates flush in each locker door, near top, centered.

F. Complete fabrication, including assembly, finishing, 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.
1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that the parts fit as intended, and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
2. Use only manufacturer's nuts, bolts, screws, and other devices for assembly.

G. Shop cut openings, to maximum extent possible, to receive hardware, 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that furring is attached to concrete and masonry walls that are to receive lockers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Install wood support base with 1/2-inch- (13-mm-) thick, plywood top.

B. Install lockers level, plumb, and true; use concealed shims.

C. Connect groups of lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.

D. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Installation Tolerance: No more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line. Shim as required with concealed shims.
   2. Maintain veneer sequence matching of wood-faced wood lockers.

E. Locker Anchorage: Fasten lockers through wood locker base, at ends, and not more than 36 inches (910 mm) o.c. with No. 8 flush-head wood screws sized for 1-inch (25-mm) penetration into wood base.

F. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

G. Install number identification plates after lockers are in place.
   1. Attach number identification plate on each locker door, near top, centered, with at least two screws with finish matching the plate.

H. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches (1830 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

I. Movable Locker Benches: Place benches in locations indicated on Drawings.

3.4 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.5 PROTECTION

A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

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SECTION 10 5123

PLASTIC-LAMINATE-CLAD LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic-laminate-clad wood lockers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker.

B. Shop Drawings: For plastic-laminate-clad wood lockers.
   1. Include plans, elevations, sections, and attachment details.
   2. Show details full size.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in lockers.
   5. Show locker fillers, trim, base, sloping tops, and accessories.
   6. Show locker identification system and numbering sequence.

C. Samples for Verification: For the following products:
   1. Plastic-laminate-clad panels, not less than 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
   2. Thermoset decorative-overlay-surfaced panels, not less than 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.
   3. Corner pieces of locker front frame joints between stiles and rail, as well as exposed end pieces, not less than 18 inches wide by 18 inches high by 6 inches deep (457 mm wide by 450 mm high by 152 mm deep).
   4. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Locker doors, complete with specified door hardware. Furnish no fewer than five doors of each type and color installed.
   2. Units of the following locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
      a. Hinges.
      b. Pulls.
      c. Shelf rests.
      d. Cylinder locks.
      e. Hooks.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical corner, including one locker on each side of corner and corner filler, including door panel with specified door hardware, as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install lockers until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
   1. Locate concealed framing, blocking, and reinforcements that support lockers by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where lockers are indicated to fit to other construction, establish dimensions for areas where lockers are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of concealed wood support bases.
   1. Requirements are specified in Section 061053 "Miscellaneous Rough Carpentry."

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that lockers can be supported and installed as indicated.

C. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 08 7100 "Door Hardware" to fabricator of lockers; coordinate Shop Drawings and fabrication with hardware requirements.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of locks or hardware.
      c. Deterioration of wood, finishes, and other materials beyond normal use.
   2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and Texas Accessibility Standards (TAS).

2.2 PLASTIC-LAMINATE-CLAD WOOD LOCKERS

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. Hollman, Inc.
   2. Classic Woodworking, LLC.
   3. Club Resource Group.
   4. Famous Lockers, Inc.
   5. Ideal Products, Inc.
   6. Legacy Lockers.
   7. List Industries Inc.
   8. Treeforms.

B. Basis-of-Design Manufacturer; Hollman, Inc.

C. Construction Style: Reveal overlay.
   1. Reveal Dimension: 1/2 inch (13 mm).

D. Final Assembly: Manufacturer's standard factory or knocked-down assembly.

E. Locker Body: Fabricated from particleboard -core panels covered on both sides with thermoset decorative overlay.
   1. Side Panels: 3/4 inch (19 mm) thick.
   2. Back Panel: 1/2 inch (13 mm) thick.
   3. Top Panel: 3/4 inch (19 mm) thick.
   4. Bottom Panel: 3/4 inch (19 mm) thick.
   5. Exposed Panel Edges: 3-mm-thick PVC.

F. Plastic-Laminate-Clad Wood Doors: High-pressure decorative laminate, Grade VGS, over both sides of particleboard core.
   1. Thickness: 3/4 inch (19 mm) thick.
   2. Panel Edges: 3-mm-thick PVC.

G. End Panels: Match style, material, construction, and finish of plastic-laminate-clad wood doors.

H. Shelves: Fabricated from particleboard -core panels covered on both sides with thermoset decorative overlay; fixed.
   1. Thickness: 3/4 inch (19 mm).
   2. Exposed Edges: 3-mm-thick PVC.

I. Corners and Filler Panels: 3/4-inch- (19-mm-) thick panels. Match style, material, construction, and finish of plastic-laminate-clad wood doors.

J. Continuous Finish Base: Plastic-laminate-clad, 3/4-inch- (19-mm-) thick panel that matches door faces; fabricated in lengths as long as practical to enclose base and base ends of lockers.

K. Continuously Sloping Tops: Plastic-laminate-clad, 3/4-inch- (19-mm-) thick panel that matches door faces for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practical, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:
   1. Closures: Vertical -end type.
   2. Sloping-top corner fillers, mitered.

L. Plastic-Laminate Colors, Patterns, and Finishes:
   1. As scheduled.

2.3 MATERIALS

A. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
   2. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
   3. Particleboard: ANSI A208.1, Grade M-2.

B. High-Pressure Decorative Laminate: NEMA LD 3, grades as follows:
   1. Horizontal Surfaces: Grade HGS.
   2. Vertical Surfaces: Grade HGS.

C. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

D. Anchors: Material, type, size, and finish as 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.

E. Wood Support Base: 2-by-4-inch nominal-size (51-by-102-mm, actual-size) lumber treated with manufacturer's standard preservative-treatment, nonpressure process.

2.4 HARDWARE

A. Cylinder Lock: Built-in, flush cam locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and two master keys.
   1. Key Type: Flat.
   2. Bolt Operation: Manually locking deadbolt.

B. Frameless Hinges (European Type): Fully concealed, self-closing, nickel-plated steel, with not less than 125 degrees of opening.
   1. Provide two hinges for doors 36 inches (910 mm) high and less.

2. Provide three hinges for doors more than 36 inches (910 mm) high.

C. Wire Pulls: Back mounted; 4 inches (102 mm) long, 5/16 inch (8 mm) in diameter.

D. Accessible Handle: Metal, fixed, graspable lever handle and rose trim; surface mounted.

E. Shelf Rests: BHMA A156.9, B04013.

F. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; brass finished. Attach hooks with at least two fasteners.
1. Provide hooks as indicated on Drawings.

G. Coat Rods: 1-inch- (25-mm-) diameter steel; finished to match other locker hardware.
1. Provide coat rods as indicated on Drawings.

H. Exposed Hardware Finish: Satin chrome unless otherwise indicated.

2.5 ACCESSORIES

A. Number Identification Plates: 1-1/2-inch- (38-mm-) diameter, etched, embossed, or stamped, stainless-steel plates with black numbers and letters at least 1/2 inch (13 mm) high. Identify lockers in sequence indicated on Drawings. Finish plates to match other locker hardware.

2.6 FABRICATION

A. Fabricate each locker with shelves, an individual door and frame, an individual top, a bottom, and a back, and with common intermediate uprights separating compartments.
1. Fabricate lockers to dimensions, profiles, and details indicated.
2. Ease edges of corners of solid-wood members to 1/16-inch (1.5-mm) radius.

B. Fabricate lockers square, rigid, without warp, and with finished faces flat and free of dents, scratches, and chips. Accurately factory machine components for attachments. Make joints tight and true.
1. Fabricate lockers using manufacturer's standard construction, with joints made with dowels, dados, or rabbets. Dado side panels to receive shelving except where indicated to be adjustable.

C. Accessible Lockers: Fabricate as follows:
1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

D. Number Identification Plates: Inlay number plates flush in each locker door, near top, centered.

E. Complete fabrication, including assembly, finishing, 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.
1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that the parts fit as intended, and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
2. Use only manufacturer's nuts, bolts, screws, and other devices for assembly.

F. Shop cut openings, to maximum extent possible, to receive hardware, 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.

G. Attach PVC edging to panels by thermally fusing edging to panels after panel fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that furring is attached to concrete and masonry walls that are to receive lockers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Install wood support base with 1/2-inch- (13-mm-) thick, plywood top.

B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Install lockers level, plumb, and true; use concealed shims.

D. Connect groups of lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.

E. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Installation Tolerance: No more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line. Shim as required with concealed shims.

F. Locker Anchorage: Fasten lockers through wood locker base, at ends, and not more than 36 inches (910 mm) o.c. with No. 8 flush-head wood screws sized for 1-inch (25-mm) penetration into wood base.

G. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

H. Attach sloping-top units to lockers, with end panels covering exposed ends.

I. Install number identification plates after lockers are in place.
   1. Attach number identification plate on each locker door, near top, centered, with at least two screws with finish matching the plate.

3.4 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.5 PROTECTION

A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

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SECTION 10 5330

FABRIC SUN SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pre-engineered and shop fabricated structural fabric sunscreen.

1.2 DESIGN CRITERIA

A. System to withstand imposed loads with maximum allowable deflection of span: 1/180.

B. Size and fabricate members free of distortion or defects detrimental to appearance or performance.

C. Shade structures shall be designed to meet 90 mph wind load, 10 psf snow load, and 10 psf live load, or more stringent if required by applicable code.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 3300.

B. Indicate profiles, sizes, spacing and locations of structural members, decking, connections, attachments and fasteners.

C. Submit manufacturer's installation instructions under provisions of Section 01 3300.

1.4 WARRANTY

A. Provide with minimum 10-year warrranty against color fading and finish degredation of fabric and framing finish.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Superior Shade.

B. USA Shade and Fabric Structures.

C. Basis-of-Design Manufacturer: Superior Shade.

D. Modular, pre-fabricated, and include the structural steel frame, fabric roof, steel cables, all fasteners, light fixtures, and installation of structures.

2.2 MATERIALS

A. Steel: Steel members shall be designed in strict accordance with the requirements of the “American Institute of Steel Construction” (AISC) Specifications and the “American Iron and Steel Institute” (AISI) Specifications for Cold Formed Members.
   1. Connections shall have a maximum internal sleeving tolerance of .0625 inches using high tensile strength sections with a minimum sleeve length of 6 inches.
   2. Non-hollow structural steel members shall comply with ASTM A-36.
   3. Hollow structural steel members shall be cold formed, high strength steel and comply with ASTM A-500, Grade C.
   4. Steel plates shall comply to ASTM A-572, Grade 50.
   5. Galvanized steel tubing shall be triple coated for rust protection using an in-line electro-plating coat process. All galvanized steel tubing shall be internally coated with zinc and organic coatings to prevent corrosion.
   6. Structural field connections of the shade structure shall be designed and made with high strength bolted connections using ASTM A-354, Grade B or SAE J249, Grade 8.

B. Stainless steel bolts shall comply with ASTM F-593, Alloy Group 1 or 2. All bolt fittings shall include rubber washer for water tight seal at joints. All nuts shall comply with ASTM-F-594, Alloy Group 1 or 2.

C. Welding: All shop welded connections of the shade structure shall be designed and performed in strict accordance with the requirements of the “American Welding Society” (AWS) Specifications. Structural welds shall be made in compliance with the requirements of the “Prequalified” welded joints where applicable and by certified welders. No onsite or field welding shall be permitted.

D. Powder Coating:
1. Galvanized steel tubing preparation prior to powder coating shall be executed in accordance to solvent cleaning SSPC-SP1. A mechanical method prior to solvent cleaning prior to surface preparation shall be executed according to Power Tool Cleaning SSPC-SP3 and utilizing wire brushes abrasive wheels and needle gun, etc., carbon,
2. Structural steel tubing preparation prior to powder coating shall be executed in accordance to commercial blast cleaning SSPC-SP6. A commercial blast cleaned surface, when viewed with out magnification, shall be free of all visible oil, grease, dirt, mill scale, rust, coating, oxides, corrosion, products and other foreign material.
3. Powder coating shall be sufficiently applied, with a minimum 3 mils thickness, and cured at the recommended temperature to provide proper adhesion and stability to meet salt spray and adhesion tests as defined by the American Society of Testing Materials.

E. Tension Cables: Steel cable is determined based on calculated engineering load.
1. For light and medium loads; ¼" (nominal) galvanized 7x19 strand cable to be used.
2. For heavy loads; 3/8' (nominal) galvanized 7x19 cable to be used.

F. Fabric Roof Systems: UV stabilized, HDPE.
1. Mesh shall be rashel knitted with monofilament and tape yarn filler to ensure that material will not unravel and tape yarn filler to ensure that material will not unravel if cut.
2. Panel Width: 10 feet.
3. Fire Testing: Fabric shall conform and pass the ASTM E84 testing standard.
4. The fabric knit is to be made of 195g per square meter,
5. Material to be Rashel-knitted to ensure material will not unravel if cut.
6. Fabric Properties:

Stretch	Stentored
Fabric Weight (oz/m2)	6.9
Fabric Width	10 ft.
Roll length	164ft
Roll Size	63" x 16.5"
Weight	68 lb.
Life Expectancy	10 years in sun
Fading	Minimum fading after 6 years (3 years for red)
Temperature	-22° F
Maximum Temperature	+ 176° F

7. Stitching and Thread: All sewing threads are to be double stitched.
8. Thread shall be GORE Tenara Sewing thread manufactured from 100% expanded PTFE; mildew resistant exterior approved thread. Thread shall meet or exceed the following:
   a. Flexible temperature range
   b. Very low shrinkage factor
   c. Extremely high strength, durable in outdoor climates
   d. Resists flex and abrasion of fabric
   e. Unaffected by cleaning agents; acid rain, mildew, salt water and rot resistant, unaffected by most industrial pollutants.
   f. Treated for prolonged exposure to the sun.

2.3 COMPONENT FABRICATION

A. Fabricate members in accordance with manufacturer's standard profiles.

B. Structure: Sizes as required to support loads.

C. Uniformly dimension and form members to exact lengths to avoid field cutting.

D. Fabrication of component profiles on site not permitted.

2.4 FINISH

A. Framing Members: Factory applied powder coating as selected by Architect.

B. Fabric: Color as selected by Architect.

PART 3 - EXECUTION

3.1 ERECTION

A. Construct concrete footing in accordance with manufacturer's engineered drawings.

B. Erect all components in accordance with manufacturer's recommendations.

C. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Architect.

E. Securely fasten fabric to structured.

F. System: Free of rattles, noise due to thermal movement, and wind whistles.

3.2 TOLERANCES

A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.

END OF SECTION

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SECTION 10 9900

MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous specialty items as listed herein.

1.2 ACTION SUBMITTALS

A. Product Data: Including all pertinent performance characteristics and criteria.

B. Shop Drawings: Indicate materials, construction, sizes, quantities, finishes, and installation details.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Instructions: For installation, maintenance, and repair.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Fire Control Key Box: Provide fire department key control box complete with alarm tamper switch at location near main entrance to be determined.
   1. Acceptable Product: Model 3200 by Knox Box.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this Section.

B. Notify Architect of any existing conditions which will adversely affect execution.

C. Beginning of execution will constitute acceptance of existing conditions.

3.2 PREPARATION

A. Prepare substrate surfaces as recommended by manufacturer.

3.3 INSTALLATION

A. Install using skilled workers in accordance with manufacturer's published instructions and recommendations.

3.4 ADJUSTING

A. Adjust and fit items to be flush with adjacent construction.

B. Fasten or adhere for tight connections and joints.

END OF SECTION

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SECTION 11 2300

COMMERCIAL LAUNDRY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Washer extractors.

1.2 REFERENCES

A. UL Certification: Provide electric equipment and components that are evaluated by UL for fire, and electric shock according to applicable safety standards and that are UL certified for compliance and labeled for intended use.

B. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.

B. Shop Drawings: Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.

C. Coordination Drawings: Indicate locations of laundry equipment and connections to utilities, and clearance requirements for equipment access and maintenance.

D. Operation and Maintenance Data: For laundry equipment to include in emergency, operation, and maintenance manuals. Include a schedule with the following:
   1. Designation indicated on Drawings.
   2. Manufacturer's name and model number.
   3. List of factory-authorized service agents with addresses & phone numbers.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store equipment on site protected from weather, direct sunlight and temperature extremes. Do not remove packaging prior to storage.

B. Consult manufacturer if machines are to be stored for an extended period of time.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 WARRANTY

A. Washer Extractor Parts Only: Manufacturer's standard form in which manufacturer agrees to repair or replace any part of the equipment assembly that fails within specified warranty period.
   1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Washer Extractors - Stainless Steel: ASTM A 666, Type 304 with No. 4 finish (directional satin finish) on exposed surfaces.

2.2 WASHER EXTRACTOR

A. Basis-of-Design Product: Extractor Corporation; Suitmate.

B. General Characteristics:
1. Frame: Heavy duty structural steel A-frame.
2. Construction: Cylinder, tub and front panel, 304 grade stainless steel.
3. Mounting: Wall mounted with manufacturer's standard wall mount brackets.
4. Drain Valve: Automatically opens in event of power failure.
5. Dimensions: 15 inches wide by 15 inches deep by 23 inches high.
6. Cycle Time: 8 seconds.
7. Spin Speed: 3450 RPM.
8. Drive Motor: 1/3 hp.
9. Electrical Requirements: 115V/60Hz/20 Amp.
   a. Power Consumption: 1.82 watts per cycle.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. System Startup and Commissioning: Arrange for a local manufacturer's representative to inspect machines prior to startup and operation.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 11 3013

RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Residential appliances.
2. Cooking appliances.
3. Kitchen exhaust ventilation.
4. Refrigeration appliances.
5. Cleaning appliances.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED, CONTRACTOR-INSTALLED RESIDENTIAL APPLIANCES

A. Coffee maker as scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION

SECTION 11 5224

FLAT SCREEN TV MOUNTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes flat screen TV hanger assembly.

1.2 ACTION SUBMITTALS

A. Product Data: Submit product data for Flat Screen TV Hanger Assembly.

B. Shop Drawings: Submit shop drawings for Flat Screen TV Hanger Assembly.

C. Show location and details including support assembly and television mount.

1.3 INFORMATIONAL SUBMITTALS

A. Informational Submittals: Submit following:
   1. Certifications specified in Quality Assurance article.
   2. Qualification Data: Manufacturer's qualification data.
   3. Manufacturer's instructions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.

B. Certifications: Submit manufacturer's certification that products furnished for Project meet or exceed specified requirements.

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. Bretford Manufacturing, Inc.
   2. Draper, Inc.
   3. Hardcraft (formerly Lucasey).
   4. Peerless Industries, Inc.

2.2 FLAT SCREEN TV HANGER ASSEMBLY

A. Components:
   1. Support column: Extruded aluminum tubular section with matt black powder coat finish and top and bottom steel plates for wall attachment.
      a. Provide channel on side of column for cable management. Video cables to be retained in channel with clips.
   2. Tilt mechanism: Steel rectangular frame attached to column and equipped with mating bracket to accept keystone plate of plasma monitor bracket. Plasma display may be installed horizontally or vertically.
   3. Finish: Matte black powder coat.
   4. Adjustment capability:
      a. Tilt: 15 degrees.
      b. Rotation: 20 degrees.
   5. Load Capacity: As required to safely support screen.
   6. Wall-mounting Bracket: Provide assembly consisting of cover plate, mounting plate, and wall framing reinforcement brackets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions under which work of this Section is to be installed. Do not proceed until unsatisfactory conditions have been corrected.

B. Verify wood blocking has been integrated into wall construction to accept secure attachment of flat screen TV hanger assemblies. Do not attach to assemblies to gypsum board.

3.2 INSTALLATION

A. Flat Screen TV Hanger Assembly: Install in accordance with Section 01 7300 and approved shop drawings.
   1. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.

B. Use fasteners which are appropriate to substrate and recommended by manufacturer of unit.

C. Install units firmly anchored in locations and at heights indicated.

3.3 ADJUSTING

A. Adjust parts for smooth, uniform operation.

3.4 CLEANING AND PROTECTION

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage finish or surrounding construction.

END OF SECTION

SECTION 11 6623

GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Basketball equipment.
2. Safety pads.

1.2 DEFINITIONS

A. NBA: National Basketball Association.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include assembly, disassembly, and storage instructions for removable equipment.

B. Shop Drawings: For gymnasium equipment.
1. Include plans, elevations, sections, and attachment details.
2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, and operational clearances.
3. Include transport and storage accessories for removable equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, reflected ceiling plans, and other details, drawn to scale, and coordinated with ceiling-suspended gymnasium equipment, floor inserts, game lines, and markers applied to finished flooring, and coordinated with each other, using input from installers of the items involved:
1. Structural members to which overhead-supported gymnasium equipment will be attached.
2. Suspended ceiling components, if any.
3. Items supported from building structure above the courts, including the following:
a. Luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Smoke detectors.
f. Acoustical treatments or panels.
g. Access panels.

B. Setting Drawings: For embedded items and cutouts required in other work.

C. Qualification Data: For Installer.

D. Product Certificates: For each type of gymnasium equipment.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Basketball backboard failures, including glass breakage.
      b. Faulty operation of basketball backstops.
   2. Warranty Period:10years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BASKETBALL EQUIPMENT

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. Draper Inc.
   2. Porter Athletic Equipment Company.
   3. Spalding Equipment.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Standard Rules: Provide equipment according to the requirements of NBA's "Official Rules of the National Basketball Association."

D. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

E. Connections: Manufacturer's standard connections or connections recommended in writing by manufacturer and complying with Section 05 5000 "Metal Fabrications" of size and type required to transfer loads to building structure.

F. Basketball Backboards:
   1. Shape and Size:
      a. Rectangular, 72 by 42 inches (1830 by 1070 mm) width by height.
   2. Backboard Material: Provide with predrilled holes or preset inserts for mounting goals, and as follows:
      a. Glass: Minimum 1/2-inch- (13-mm-) thick, transparent tempered glass according to ASTM C 1048 Kind FT (fully tempered) and with impact-testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing. Provide glass and framing system manufactured according to FIBA Level 1 or Level 2 requirement that glass does not split off if broken.
         1) Frame: Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, painted steel frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backstop.
         2) Rim-Restraining Device: According to NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.
      b. Steel: Single-piece, steel face sheet, minimum 0.1046-inch (2.7-mm) nominal thickness, with 1-1/2-inch- (38-mm-) deep, roll-edged perimeter flange and with steel-reinforced, welded frame welded to back side of backboard; with mounting slots for mounting backboard frame to backstop at standard mounting centers.
      c. Hardwood or Particleboard: Minimum 1-1/2-inch- (38-mm-) thick backboard consisting of minimum 1/32-inch- (0.8-mm-) thick, phenolic-resin-impregnated cellulose and paper laminate over front and back sides of 1-1/2-inch (38-mm) hardwood or particleboard core; with painted edges and corners and with threaded inserts or slotted brackets for mounting backboard corners to backstop at standard mounting centers.
   3. Target Area and Border Markings: Permanently etched in white color, marked in pattern and stripe width according to referenced standard rules.
   4. Finish: Manufacturer's standard factory-applied, white background.
   5. Goal Height Adjuster: Adjustable from 8 to 10 feet (2.40 to 3.05 m) to top of ring with gear-drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.
      a. Operation:
         1) Manual operation with detachable crank handle.

G. Goal-Mounting Assembly: Compatible with goal, backboard, and backstop; with manufacturer's standard hole pattern for goal attachment.
   1. Glass Backboard Goal-Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backstop and to minimize stresses on glass backboard.

H. Basketball Goals: Basket ring complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
   1. Double-Rim Basket Ring: Fabricated with two rims, manufacturer's standard-diameter steel rod welded into 18-inch (460-mm) ID rings.
   2. Type:
      a. Fixed: Nonmovable.
   3. Mount: Front.
   4. Finish: Polyester powder-coat finish.

I. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches (380 to 460 mm) long, sized to fit ring diameter, and as follows:
   1. Cord: Made from white nylon.

2.2 SAFETY PADS

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. Draper Inc.
   2. Porter Athletic Equipment Company.
   3. Spalding Equipment.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

D. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, minimum 14-oz./sq. yd. (475-g/sq. m) and 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. Backer Board: Minimum 3/8-inch- (9.5-mm-) thick fire-retardant-treated plywood by pressure process according to AWPA U1, Use Category UCFA Fire Retardant Interior.
   2. Fill: Multiple-impact-resistant foam, minimum 2-inch- (50-mm-) thick polyurethane, 3.5-lb/cu. ft. (56-kg/cu. m) density.
   3. Size: Each panel section as indicated on Drawings.
   4. Number of Modular Panel Sections: As indicated on Drawings.
   5. Installation Method: Manufacturer's standard.
   6. Fabric Covering Color(s): As selected by Architect from manufacturer's full range.

F. Cutout Trim: Manufacturer's standard flanged cutout trim kits for fitting pads around switches, receptacles, and other obstructions.
   1. Color: Black.

2.3 MATERIALS

A. Castings and Hangers: Malleable iron, according to ASTM A 47/A 47M; grade as required for structural loading.

B. Softwood Plywood: DOC PS 1, exterior.

C. Particleboard: ANSI A208.1.

D. Anchors, Fasteners, Fittings, and Hardware: Gymnasium equipment manufacturer's standard corrosion-resistant or noncorrodible units; concealed.

E. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, according to ASTM C 1107/C 1107, with minimum strength recommended in writing by gymnasium-equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for court layout, alignment of mounting substrates, installation tolerances, operational clearances, and other conditions affecting performance of the Work.
   1. Verify critical dimensions.
   2. Examine supporting structure, subfloors, and footings below finished floor.
   3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions and competition rules for each type of gymnasium equipment.

B. Install gymnasium equipment after other finishing operations, including painting, have been completed unless otherwise indicated.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relationship to adjacent construction; and aligned with court layout.
   1. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

E. Removable Gymnasium-Equipment Components: Assemble in place to verify that equipment and components are complete and in proper working order. Disassemble removable gymnasium equipment after assembled configuration is approved by Architect, and store units in location indicated on Drawings.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Perform visual inspections and operational tests as recommended by referenced standard rules of each sport and the equipment manufacturer.
   2. Test rebound elasticity of basketball goals.
   3. Test basketball goal pressure-release characteristics and adjustability.

C. Gymnasium equipment will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 12 3661.16

SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:
1. Countertop material, 6 inches (150 mm) square.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.6 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
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. Affinity Surfaces; a brand of Domain Industries, Inc.
b. Avonite Surfaces.
c. Cambria.
d. E. I. du Pont de Nemours and Company.
e. Formica Corporation.
f. LG Chemical, Ltd.
g. Meganite Inc.
h. Samsung Chemical USA, Inc.

i. Swan Corporation (The).
j. Transolid Div of Trumbull Industries.
k. Wilsonart.
2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Colors and Patterns: As scheduled.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

C. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Products: Subject to compliance with requirements, provide the following:
a. Doug Mockett & Company, Inc.: TG Flip-Top Series.
2. Outside Diameter: 2 inches (51-mm).
3. Color: As selected by Architect from Manufacturer’s full range.

D. Countertop Support Brackets: Steel, 18 inches by 24 inches, minimum 1,000 lb load limit, factory-applied primer for field painting in accordance with Section 09 9123 "Interior Painting."
1. Acceptable Products:
a. A & M Hardware; Work Station Brackets.
1) Provide manufacturer’s standard factory-applied primer. Refer to Section 09 9123 “Interior Painting” for finish coat.
2) Provide manufacturer’s standard black textured powder coat finish.

E. Countertop Support Brackets: Aluminum, 18 by 24 inches, minimum 1,000 lb. load limit.
1. Acceptable Products:
a. Rangine Corporation; Rakks, EH 1824.
1) Finish: As scheduled

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
1. Grade: Custom.

B. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material.

C. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material with wood-trimmed edges.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
1. Fabricate with loose backsplashes for field assembly.

E. Joints: Fabricate countertops without joints.

F. Cutouts and Holes:
1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
   1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION

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SECTION 12 4813

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roll-up rail mats.
2. Surface-mounted frames.

1.2 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Shop Drawings:
1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor frames.
4. Custom Graphics: Scale drawing indicating colors.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:
1. Uniform floor load of 300 lbf/sq. ft. (14.36 kN/sq. m).
2. Wheel load of 350 lb (159 kg) per wheel.

B. Accessibility Standard: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and Texas Accessibility Standards (TAS).

2.2 ROLL-UP RAIL MATS

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. Babcock-Davis.
2. Balco, Inc.
3. C/S Group.
4. Nystrom, Inc.

B. Basis-of-Design Products
1. C/S Group: PediTred LP G3 Recessed Tapered Angle Frame.
2. C/S Group: PediTred LP G3 Recessed Threshold Frame.

C. Roll-up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches (38 mm) wide by 3/8 inch (9.5 mm) thick, sitting on continuous vinyl cushions.
1. Tread Inserts: 33-oz./sq. yd. (950-g/sq. m) weight, level-cut, nylon-pile, fusion-bonded carpet.
a. Basis-of-Design Product: C/S Group; MonTuft HD.
2. Colors, Textures, and Patterns of Inserts: As selected by Architect from full range of industry colors.
3. Rail Color: Clear.
4. Hinges: Plastic.
5. Mat Size: As indicated.

2.3 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Surface-Mounted Frames: As indicated for permanent surface-mounted installation, complete with corner connectors, splice plates or connecting pins, and postinstalled expansion anchors.

C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.4 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions; coordinate with entrance locations and traffic patterns.
   1. Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer.

3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

SECTION 13 1100

SWIMMING POOL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The scope of the work included under this Section of the Specifications shall include swimming pool(s) as illustrated on the Drawings and specified herein. The General and Supplementary Conditions of the Specifications shall form a part and be included under this Section of the Specifications. The Swimming Pool Subcontractor shall provide all supervision, labor, material, equipment, machinery, plant and any and all other items necessary to complete the work. ALL OF THE WORK IN SECTIONS 13 1100 – 13 1108 IS TO BE THE RESPONSIBILITY OF ONE EXPERIENCED SWIMMING POOL SUBCONTRACTOR PRIMARILY ENGAGED IN THE CONSTRUCTION OF COMMERCIAL PUBLIC-USE SWIMMING POOLS. A SWIMMING POOL SUBCONTRACTOR SHALL BE CONSIDERED PRIMARILY ENGAGED AS REQUIRED HEREIN IF THE SUBCONTRACTOR DERIVED 50% OF ITS ANNUAL REVENUE FROM PUBLIC-USE SWIMMING POOL CONSTRUCTION FOR EACH OF THE LAST FIVE YEARS. THE SUBCONTRACTOR MUST HAVE ALSO, IN THE LAST FIVE YEARS CONSTRUCTED AT LEAST FIVE (5) COMMERCIALLY DESIGNED MUNICIPAL AND PUBLIC-USE SWIMMING POOLS, EACH OF WHICH SHALL HAVE INCORPORATED A MINIMUM SIZE OF 2,500 SQUARE FEET OF WATER SURFACE AREA. The Swimming Pool Subcontractor shall furnish and install the swimming pool structures, finishes, cantilever forming, swimming pool mechanical and electrical systems, and all accessories necessary for a complete, functional swimming pool system, as herein described. Work shall include start-up, instruction of Owner's personnel, as-built drawings and warranties as required.

1.2 CODES, RULES, PERMITS, FEES

A. The swimming pools shall be constructed in strict accordance with the applicable provisions set forth by authorities having jurisdiction over swimming pool construction and operation in the State of Texas.

B. The Swimming Pool Subcontractor shall give all necessary notices, obtain all permits, and pay all government sales taxes, fees, and other costs in connection with their work; file all necessary plans, prepare all documents and obtain all necessary approvals of governmental departments having jurisdiction; obtain all required certificates of inspection for their work and deliver same to the Designated Representative before request for acceptance and final payment for the work.

C. The Swimming Pool Subcontractor shall include in the work any labor, materials, services, apparatus, or drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on Drawings and/or specified.

D. The Contractor shall submit all required documents and materials to all Governmental Departments having jurisdiction for any deferred approval items or substituted materials or products to obtain final approval to installation.

1.3 DESCRIPTION OF WORK

A. Furnish and perform supervision, coordination, all layout, formwork, excavation, hand trim, disposing off-site of all unused material or debris to complete the swimming pool excavation to the dimensions shown on the plans.

B. Furnish and install complete swimming pool structures, including reinforcing steel and cast-in-place or pneumatically placed concrete walls and floors.

C. Furnish and install swimming pool finishes, including ceramic tile and marble plaster or other waterproof finishes.

D. Furnish and install complete swimming pool mechanical system(s), including, but not limited to, circulation systems, filtration systems, pool water heating systems, water chemistry control systems, domestic water fill line systems, booster pump and special effects systems, and all pumps, piping, valves, and connections between system(s) and swimming pool(s).

E. Furnish and install complete swimming pool electrical system(s) from P.O.C. in Mechanical Room, including, but not limited to, underwater lighting systems, water level control systems, timing systems,

scoreboards, special effects systems, control circuitry, motor starters, time clocks, bonding, and all conduits, conductors, contactors, and switches between the system(s) and swimming pool(s).

F. Furnish and install all swimming pool cantilever forming, deck equipment and required anchors and inserts for the specified equipment as required by code, shown on the Drawings and specified herein.

G. After the initial filling of the swimming pool system(s), should any repairs, continuing work, or other Subcontractor responsibility require drainage or partial drainage of the swimming pool systems, the Swimming Pool Subcontractor shall be responsible for any subsequent refilling and shall complete the project with the swimming pool system(s) full of water, water in chemical balance, complete in every way, and in full operation.

1.4 ASSIGNED RESPONSIBILITIES AND RELATED WORK

A. It is the intent of this section of the Specifications to clarify Work responsibilities of the trades directly and indirectly involved in construction of the pool systems. All labor, equipment, materials and supplies furnished by the Swimming Pool Subcontractor and other Subcontractors per the contractual agreement with the General Contractor and Owner and shall be as directed by the Owner through their Designated Representative.

B. THE SWIMMING POOL SUBCONTRACTOR SHALL NOT SUBCONTRACT ANY PORTION OF THE SWIMMING POOL CONSTRUCTION OR SWIMMING POOL EQUIPMENT INSTALLATION TO ANYONE OTHER THAN A SUBCONTRACTOR THAT SATISFIES THE REQUIREMENTS OF SECTION 131100

C. References to “swimming pool systems” shall include the swimming pools, equipment, and accessories.

D. The Owner will provide one complete water filling of the swimming pool(s), but will not assume any responsibility for the swimming pool system(s) until they have been proved fully operational, complete in every way and accepted by the Designated Representative.

1.5 RESPONSIBILITIES OF THE CONTRACTOR

A. The Contractor shall grade the swimming pool site(s), establish benchmarks, cut and fill as necessary to provide as level an area as possible at swimming pool deck elevation before swimming pool layout.

B. The Contractor shall be responsible for horizontal dimensions and grade elevations accurately from established lines and benchmarks (as indicated on the Drawings) and be responsible for those grades.

C. The Contractor shall provide adequate temporary light, electric power, heat and ventilation per Federal and State OSHA requirements to construct the swimming pool system(s).

D. The Contractor shall not permit any heavy equipment activity over any area or within five (5) feet of any area under which swimming pool piping is buried. There shall be no exceptions to this requirement.

E. The Contractor shall keep the swimming pool excavation(s) and swimming pool structure(s) free of construction residue and waste materials of their workmen or Subcontractors, removing said material from the swimming pools as required.

F. The Contractor shall protect the swimming pool(s) from damage caused by their construction equipment and /or workmen and Subcontractors.

G. The Contractor shall provide a representative at time of swimming pool start-up to coordinate all trades related to swimming pool system(s).

1.6 RESPONSIBILITIES OF THE MECHANICAL SUBCONTRACTOR

A. The Mechanical Subcontractor shall be licensed in the State of Texas and provide written notifications to Swimming Pool Subcontractor and contractor when necessary to excavate and backfill within the swimming pool construction site.

B. The Mechanical Subcontractor shall not utilize any swimming pool piping trench for installation of any sanitary sewer, storm sewer, domestic water, hot water, chilled water or natural gas line.

C. The Mechanical Subcontractor shall furnish and install all sanitary sewer piping, including vent stacks (if necessary), for backwash pits, floor drains and floor sinks as required by code, shown on Drawings, and herein specified.

D. The Mechanical Subcontractor shall furnish and install all storm sewer piping and site drainage systems as required by code, shown on the Drawings, and herein specified.

E. The Mechanical Subcontractor shall provide a minimum 75 psi water supply for swimming pool construction work within fifty (50) feet of the swimming pool construction site(s).

F. The Mechanical Subcontractor shall furnish and install reduced pressure backflow protected domestic water lines to P.O.C. within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.

G. The Mechanical Subcontractor shall furnish and install natural gas piping, pressure regulation and valving to P.O.C. within swimming pool Mechanical Room as required by code, shown on the drawings, and herein specified.

H. The Mechanical Subcontractor shall furnish and install all ductwork, louvers, and all HVAC equipment within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.

I. The Mechanical Subcontractor shall provide a representative at time of swimming pool start-up to coordinate work related to swimming pool system(s).

1.7 RESPONSIBILITIES OF THE ELECTRICAL SUBCONTRACTOR

A. The Electrical Subcontractor shall be licensed in the State of Texas and shall furnish and install electrical service to swimming pool Mechanical Room sized to accommodate all necessary swimming pool equipment as shown on the Drawings and herein specified.

B. The Electrical Subcontractor shall furnish any temporary power needed by the Swimming Pool Subcontractor within fifty (50) feet of the swimming pool construction site(s).

C. The Electrical Subcontractor shall furnish and install all conduits, conductors, starters/disconnects, panels, circuits, switches and equipment as required for lighting, ventilation and HVAC equipment within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.

D. The Electrical Subcontractor shall furnish and install all conduits, conductors, panels, circuits, switches and equipment for area lighting as required by code, shown on the Drawings, and herein specified.

E. All equipment, material and installation shall be as required under Division 16 of the Specifications and shall conform to NEC Article 680 (latest revision), State and Local Codes, and as may be required by all authorities having jurisdiction over swimming pool construction within the State of Texas.

F. The Electrical Subcontractor shall provide a representative at time of swimming pool start-up to coordinate work related to swimming pool system(s).

1.8 INTENT

A. It is the intention of these specifications and Drawings to call for finished work, tested and ready for operation. Wherever the work “provide” is used, it shall mean “furnish and install complete and ready for use.”

B. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.9 SCHEDULE OF VALUES

A. Provide a Schedule of Values for all work specified in each of the technical specifications listed in the table below, regardless of whether the work is performed by the swimming pool contractor or others. Values listed shall be fully burdened, with contractor general conditions, overhead, profit and bonds included. Payments for swimming pool work completed shall not be approved until Schedule of Values has been submitted to and approved by Architect.

SWIMMING POOL SCHEDULE OF VALUES

No.	Section #	Description	Value
1.	13 1101	Swimming Pool Excavation	
1.	13 1102	Swimming Pool Concrete	
2.	13 1103	Swimming Pool Shotcrete	
3.	13 1104	Swimming Pool Ceramic Tile	
4.	13 1105	Swimming Pool Plaster	
5.	13 1106	Swimming Pool Equipment	
6.	13 1107	Swimming Pool Mechanical	
7.	13 1108	Swimming Pool Electrical	

Total	

1.10 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Subcontractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing submittals with performance construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity. 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.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for schedules performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for re-submittals as follows. Time for review shall commence on Architect's receipt of submittal.
   1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contract when a submittal being processed must be delayed for coordination.
   2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow twenty-one (21) days for initial review of each submittal.
   3. Direct Transmittal to Consultant: Where the Contract Documents indicate that submittals may be transmitted directly to Architect's consultants, provide duplicate copy of transmittal to Architect. Submittal will be returned to Architect before being returned to Subcontractor.
   4. If intermediate submittal is necessary, process it in same manner as initial submittal.
   5. Allow fifteen (15) days for processing each submittal.
   6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a title block on each submittal for identification.
   1. Indicate name of firm or entity that prepared each submittal on title block.
   2. Provide a space on title block to record Subcontractor's review and approval markings and action taken by Architect.
   3. Include the following information on title block for processing and recording action taken: (See Attached Sample)
      a. Project name.
      b. Date.
      c. Name and address of Subcontractor.
      d. Name of Subcontractor.
      e. Name of Supplier.
      f. Name of Manufacturer.
      g. Unique identifier, including revision number.
      h. Number and title of appropriate Specification Section.
      i. Drawing number and detail references, as appropriate.
      j. Other necessary identification.

SUBMITTAL FOR:	SUBMITTAL TO:	SUBCONTRACTOR:

Item Number: _____
Section Number: _____
Section Description: _____
Subcontractor: _____
Supplier: _____
Manufacturer: _____
Product Code: _____
Quantity: _____

Subcontractor Certification:

It is hereby certified that the equipment or material designated in this submittal is proposed to be incorporated in the above-named project and is in compliance with the contract drawings and / or specifications and is submitted for approval.

Certified by: _____

Date: _____

Job Superintendent: _____

Revisions: _____

Contractor's Submittal Stamp:

Architect's Review Stamp and Comments

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract documents on submittal.

G. On all catalogue or cut sheets identify which model or type is being submitted.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Product data and shop drawings shall be packaged within a three-ring binder and colored samples shall be packaged on a heavy cardboard. Transmit each submittal using a transmittal form.
   1. On an attached separate sheet, prepared on Subcontractor's letterhead, record relevant information, request for data, revisions other than those requested by Architect on previous submittals and deviations from requirements of the Contract documents, including minor variations and limitations. Include the same label information as the related submittal.
   2. Include Subcontractor's certification stating that information submitted complies with requires of the Contract Documents.
      a. Transmittal Form: Provide locations on form for the following information:
      b. Project name.
      c. Date.
      d. Destination (To:).
      e. Source (From:).
      f. Names of Subcontractor, manufacturer, and supplier.
      g. Category and type of submittal.
      h. Submittal purpose and description.
      i. Remarks.

I. Distribution: Furnish copies of final submittals to manufacturers, Subcontractors, suppliers, fabricators, installers, authorities having jurisdiction and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

1.11 SUBSTITUTIONS

A. To obtain approval to use unspecified products, bidders shall submit requests for substitution at least ten (10) days prior to bid date. Requests shall only be considered if they clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. All unspecified products and equipment will be considered on an “or equal” basis at the discretion of the Designated Representative. Requests for substitution received after the specified deadline will not be considered. Where a conflict exists between the requirements of the General Conditions / Special Conditions / Division 1 concerning substitutions and the requirements of this Article shall govern.

B. Where the Swimming Pool Subcontractor proposes to use an item of equipment other than that specified or detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring, or any other part of the architectural, mechanical, or electrical layout, all such redesign and all new drawings (stamped by Texas Licensed Engineer) and detailing required shall be prepared by the Swimming Pool Subcontractor, at their own expense, submitted for review and approval by the Designated Representative prior to bid.

C. Where such approved deviation requires a different quantity and arrangement of piping, supports and anchors, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Swimming Pool Subcontractor shall furnish and install any such piping, structural supports, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

1.12 SURVEYS AND MEASUREMENTS

A. The Swimming Pool Subcontractor shall base all measurements, both horizontal and vertical, from benchmarks established by the Contractor. All work shall agree with these established lines and levels. The mechanical Drawings do not give exact details as to elevations of piping, exact locations, etc. and do not show all offsets, control lines, pilot lines and other installation details. Verify all measurements at site and check the correctness of same as related to the work.

1.13 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of the systems and work included in the Subcontractor. Drawings are not to be scaled. The architectural drawings and details shall be examined

for exact dimensions. Where they are not definitely shown, this information shall be obtained from the Designated Representative.

1.14 SWIMMING POOL SUBCONTRACTOR

A. The swimming pool construction work as herein described and specified in Division 13 of the Project Manual shall be the complete responsibility of a qualified and specifically licensed (C-53 license classification within the State of Texas) Swimming Pool Subcontractor with extensive experience in commercial public use swimming pool installations.

B. The Contractor shall require the Swimming Pool Subcontractor to furnish to the Contractor performance and payment bonds in the amount of 100% of the Swimming Pool Subcontractor's bid written by a surety Company properly registered in the State of Texas and listed by the U.S. Treasury. The expense of the bond(s) is to be borne by the Subcontractor. The Contractor shall clearly specify the amount and requirements of the bond(s) in the Contractor's written or published request for subbids. The Contractor's written or published request for subbids shall also specify that the bond(s) expense is to be borne by the Subcontractor.

C. Subcontractor certifies that it meets the qualifications and experience requirements established in Swimming Pool General Requirements, Section 13 1100, as follows:

1. Subcontractor has derived 50% of its annual revenue from public-use swimming pool construction for each of the last five (5) years.
2. Subcontractor has, in the last five (5) years, constructed at least five (5) commercially designed municipal and public-use swimming pools, each of which have incorporated a minimum size of 2,500 square feet of water surface area.
3. The following list of projects meet the requirements of section (b) above and the contact as reference by the Contractor, the Awarding Authority of their agent or designee.

a. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

b. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

c. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

d. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

e. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

1.15 OPERATING INSTRUCTIONS

A. The Swimming Pool Subcontractor shall determine from actual samples of pool water supplied by the Owner, the proper water management program necessary for maximum operating efficiency and comfort.

The Swimming Pool Subcontractor shall provide the services of experienced personnel familiar with this type of pool system operation, in conformance with Section 13 1105 of the Specifications.

1.16 MAINTENANCE MANUALS

A. The Swimming Pool Subcontractor shall provide six (6) bound sets for delivery to the Designated Representative of instructions for operating and maintaining all systems and equipment included in this Contract. Manufacturer's advertising literature or catalog pictures will not be acceptable for operating and maintenance instructions.

B. Bound in ring binders shall be all parts lists, periodic maintenance instructions and troubleshooting guidelines for all pool equipment, including but not limited to filters, pumps, controllers, water chemistry control equipment, etc.

1.17 SECURE FROM THE OWNER

A. A complete Owner-furnished filling of the swimming pools.

B. The Owner's assistance, as specified herein, from the time of start-up until final written acceptance of the swimming pool system(s).

C. Chemicals as required for swimming pool operation after Swimming Pool Subcontractor completes initial water chemistry balance and water treatment during the maintenance period described in Section 13 1105 of the Specifications.

1.18 WARRANTY

A. The Swimming Pool Subcontractor shall warrant all swimming pool structures, finishes and systems against defects in material and workmanship for a period of one year after the date of acceptance by the Owner. Any repair or replacement required due to defective material or workmanship will be promptly corrected by the Swimming Pool Subcontractor.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 13 1101

SWIMMING POOL EXCAVATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All finish and fine grading to bring the surface of the ground to the required grades and elevations as indicated on the Drawings.

B. Subgrade improvements and placing of compacted fills.

C. Excavation and backfill for all swimming pool structural requirements, including footings, foundations, grade beams, slabs and walls.

1.2 QUALITY ASSURANCE

A. All Work of this Section shall be performed or supervised by the Swimming Pool Subcontractor.

B. Requirements of Regulatory Agencies: Conform with requirements of the General Conditions, and more specifically the following:
   1. Conform with The International Building Code, latest edition.
   2. Comply with applicable construction safety orders, latest edition, State of Texas.
   3. Comply with applicable trench safety provisions, latest edition, State of Texas.

C. Qualifications of Workers:
   1. The contractor / subcontractor for this portion of the Work shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of this work, have five (5) completed projects in that period, and shall demonstrate to the approval of the Owner's Representative that his record of workmanship is satisfactory.
   2. For actual construction operations, use only thoroughly trained and experienced workers completely familiar with the materials and methods specified.
   3. Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly familiar with the type of materials being installed, the referenced standards, and the requirements of this Work, and who shall direct all Work performed under this Section.

D. Project/Site Conditions:
   1. Be familiar with site and subsurface conditions.
   2. Excavation is unclassified and includes excavation to subgrade elevations indicated or necessary, regardless of character of materials and obstructions encountered.
   3. Provisions for mitigation of wet soils due to seepage or rain shall be made during excavation and throughout construction. If wet soils are encountered within the swimming pool excavations, de-watering shall be provided in accordance with the recommendations of the soils engineer.
   4. Where slope instability is encountered, all excavations within those areas shall be 1:1 or flatter. Forming of vertical walls may be necessary, and all soil conditions shall be field verified by Geotechnical Engineer.
   5. The availability of records of investigations of soil or subsurface conditions and/or logs of test borings:
      a. Shall not be construed as a waiver of the Contractor's duty to examine the site of the Work contemplated, and the Contractor is cautioned to make such independent investigations and examinations as the Contractor deems necessary to satisfy the Contractor as to the subsurface conditions to be encountered in the performance of the Work
   6. Will not relieve the Contractor from the risk of unanticipated soil or subsurface conditions or from properly fulfilling the terms of the Contract at the Contract Sum.
   7. If soil or subsurface conditions are encountered which require, in the opinion of the Owner's Representative, design details which differ from those design details shown in the Contract Documents and the Owner's Representative finds that such revised design details will cause an increase or decrease in the cost of, or the time required for performance of the Contract, the Owner's Representative will, after approval by the Owner, modify the Contract terms in writing to provide for the change in design details and to provide for an adjustment in cost and/or time of performance as permitted in the General Conditions. A change in "design details" is defined as a change in the size or character of the Work made necessary by differing conditions, such as the

requirement for a change in the depth or size of a footing or foundation, or for a change in the indicated reinforcement.

8. Off-site Access: Verify all limitations imposed by public jurisdictions on off-site construction routes.
9. On-site Access: Use on-site access routes designated by the Owner. Maintain these routes during construction. At completion of construction restore routes to original condition at no additional cost to the Owner.
10. Unusual Site Conditions: In the event that unusual site conditions, not defined by the Contract Documents, are encountered; discontinue work in the affected area, and notify Owner's Representative immediately.

E. Adverse Weather Conditions:
1. During the periods when site soil moisture content is substantially in excess of moisture content required for optimum compaction, do not perform fill compaction.
2. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in accordance with the requirements of Section 01 3300.

1.4 SITE VISITATION

A. In preparing a proposal, the Contractor is required to have visited the site, carefully examined the Bidding Documents, and determined to his satisfaction the methods of removal and storage of materials, the sequencing of operations and the problems attendant thereto. No allowance will be made subsequently to the Contractor for any error through negligence in observing the site condition.

1.5 EXCAVATING & TRENCHING, GENERAL REQUIREMENTS

A. Before beginning any excavation five feet or more in depth, Contractor shall submit to Owner's Representative a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during excavation. The proposed plan shall comply with the standards established by the International Building Code and Federal / State OSHA regulations. If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer whose name and registration number shall be indicated on the Drawing. If a dispute arises as to whether the plan must be prepared by a registered civil or structural engineer, the Owner's Representative's determination of the matter shall be final and conclusive. The cost of required engineering services shall be borne by Contractor and shall be deemed to have been included in the amount bid for the Work as stated in the Agreement.

B. The review of any plan showing design of shoring, bracing, sloping, or other provisions for worker protection, by the Owner's Representative shall not relieve the Contractor from obligation to comply with construction safety order standards and building code for design and construction of such protective work, and Contractor shall indemnify Owner and Owner's Representative from any and all claims, liability, costs, actions, and causes of action arising out of or related to the failure of such protective systems. Contractor shall defend Owner, its officers, employees, consultants and agents in any litigation proceeding brought with respect to the failure of such protective systems.

C. All trenches, holes, etc. are to be completely protected using solid barricades, steel plates, and plywood both during construction and during off hours, including night time.

D. Flashing warning light barricades are required on sidewalks, roads, and any other critical areas that require night time protection.

E. Roads, paths and sidewalks shall not be blocked at any time or in any way. Trenching across roads, paths or sidewalks involves special instructions and review of the construction procedure by the Owner's Representative at least three (3) days prior to the Work actually being started.

F. Construction equipment, including all trucks, cars, etc. shall not be parked or driven on roads, paths or sidewalks. Items not allowed on roads, paths or sidewalks include hoses, power cords, ropes, construction materials, dirt and debris, etc.

G. All roads, paths and sidewalks must remain clear and the Contractor shall maintain temporary safe and effective pedestrian access at all times.

H. Drawings show existing major underground utilities using the best information available. The Swimming Pool Subcontractor and any subcontractors shall also fully check public works reference drawings prior to excavation. Call local Dig Alert to locate utilities to ensure safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill Material, General: All material shall be subject to the review of the Geotechnical Engineer to determine acceptability.

B. On-site soils are considered suitable for use in engineered fill construction, if free of significant concentrations of organics, landscape materials, rubble or debris. Imported fill materials, if required, shall be free of contamination with proper documentation and shall be approved by the Soils Engineer prior to being transported to the site. Imported fill materials shall be granular compactable soils with a Plasticity Index of 15 or less, an Expansion Index of 20 or less, and free of particles greater than three inches in maximum dimension with no more than five percent of the material greater than one-inch in maximum dimension.

C. Soils exposed within the swimming pool excavations should be maintained in a moist condition until the construction of the pool walls. The intent of this recommendation is to reduce the potential of desiccation cracking within clay soil behind the pool walls.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify drawing dimensions and elevations with actual field conditions. Inspect related Work and adjacent surfaces and report discrepancies and conditions which prevent proper execution of the Work to the Owner's Representative.

3.2 SUBGRADE IMPROVEMENTS

A. Following site clearing activities, structural areas designated to receive fill, achieved by excavation or remain at grade, shall be ripped and cross-ripped to a depth of at least 12 inches, thoroughly moisture conditioned to the optimum moisture content, and uniformly compacted to at least 90 percent relative compaction. Relative compaction shall be based on the maximum dry density as determined in accordance with ASTM D1557 test method.

3.3 EXCAVATION

A. Checking Layout: Contractor shall, before commencing the excavation work, check all lines, stakes and levels for dimensions, angles, elevations and grades with the survey.

B. Excavate for footings, foundations and slabs to depths indicated on Drawings. Elevations and depths of excavations shown on the Drawings shall govern and will be basis for bidding and execution of work except as otherwise may be directed by the Owner's Representative. Greater or lesser quantities of excavation and backfill required by authorized instructions shall be adjusted in accordance with the General Conditions.

C. Except where extra excavation is directed by the Owner's Representative or Geotechnical Engineer, excavations made to a greater depth or size than indicated or required shall be filled with concrete or shotcrete as specified in Sections 13 1102/ 13 1103.

D. Dimensions: Excavate to proper dimensions as shown, cut square and smooth with firm level bottoms. Prepared excavations shall be approved by Geotechnical Engineer. Excavations shall be free of loose or disturbed materials.

E. Excess Water Control: Keep all excavations free from standing water by pumping, draining or providing proper protection against water intrusion. If soil becomes soft, soggy or saturated, perform additional excavation to firm soil not affected by water.

F. Form Removal: Make all excavations of sufficient size to permit installation and removal of forms and all other required work.

G. Alternate Forming: Sides of structures may be formed by neat excavations where banks will stand without caving. If banks cave, provide forming as required and widen excavation to permit forming, bracing and inspection. Provide forming in conformance with Section 13 1102 and all recognized safety standards. Form all grade beams.

3.4 BACKFILLING

A. Method: After concrete has been placed, forms removed and concrete work approved, backfill the excavations with earth to indicated or required grades. Carry on backfilling simultaneously on each side of walls or grade beams. Remove all rubbish and wood from the excavations before placing backfill.

B. Concrete Protection: Prior to placing any backfill, adequately cure all concrete and provide any bracing required to ensure the stability of the structure. Protect waterproofing and dampproofing against damage in a manner acceptable to the Owner's Representative. Remove bracing as backfill operations progress.

C. Material: Use the material from the excavations for backfilling, subject to approval by Soils Testing Agency. The earth shall be free from debris, large clods or stones.

D. Lifts: Place backfill in six (6) inch loose layers, bring to optimum moisture content and compact to ninety percent (90%) of maximum density, sloping down and away from the structures being backfilled.

E. Moisture: Rigidly control the amount of water used to ensure optimum moisture conditions for the type of fill material used. Excessive amounts of water causing saturation of earth will not be permitted. Compaction by flooding or jetting is prohibited.

3.5 GRADING

A. Slopes: Grade to finish grades indicated on Drawings, with uniform slopes between all points.

B. Subgrades: Blade to required grade and roll or tamp subgrades for exterior slabs, decks and paving.

3.6 CLEAN-UP

A. Disposal: Haul away rubbish, debris, and rocks from site promptly and dispose of legally. Burning rubbish on site is prohibited.

B. Dust and Noise Abatement: During entire period of construction keep area and material being loaded sprinkled to reduce dust in air and annoyance to premises and surrounding property.

END OF SECTION

SECTION 13 1102

SWIMMING POOL CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Forming for cast-in-place concrete and shotcrete associated with swimming pools.

B. Reinforcement for cast-in-place concrete and shotcrete associated with swimming pools.

C. Cast-in-place concrete for swimming pool structures. Do not use waterproofing admixture of any kind.

D. Provide labor, materials and equipment as required to install sealant for all pool deck expansion joints, or any other caulking, as indicated on the aquatic Drawings and herein specified.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:
1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years' experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years' experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:
1. In addition to complying with the International Building Code (latest edition), comply with all pertinent recommendations contained in "Recommended Practice for Concrete Formwork," Publication ACI 347-78 of the American Concrete Institute.
2. In addition to complying with International Building Code (latest edition), comply with all pertinent recommendations contained in "Manual of Standard Practice for Detailing Reinforced Concrete Structures," Publication ACI 315-74 of the American Concrete Institute.
3. In addition to complying with all local codes and regulations, comply with all pertinent recommendations contained in American Society for Testing and materials (ASTM); ASTM C 920 "Standard Specification for Elastometric Joint Sealants."
4. Where provisions of applicable codes and standards conflict with the requirements of this Section, the more stringent provisions shall govern.

C. Tolerances: Construct all swimming pool concrete straight, true, plumb and square within a tolerance horizontally of one in 200 and vertically of one in 2000.

1.3 SUBMITTAL AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 3300

B. Samples and Certificates, Concrete Reinforcement:
1. Provide all data and access required for testing as described in Section 01 4500 of the Specifications.
2. All material shall bear mill tags with heat number identification. Mill analysis and report shall be made available upon request.
3. Material not so labeled and identifiable may be required by the Owner to be tested by the testing laboratory selected by the Owner and at no additional cost to the Owner, in which case random samples will be taken for one series of tests from each 2-1/2 tons or fraction thereof of each size and kind of reinforcing steel.
4. Design mix batch plant demonstrating previous use history and associated strengths at 28 days.
5. The Contractor shall submit a mix design stamped by a licensed engineer for approval by the Owner's Representative prior to any placement of concrete.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

D. Submit reinforcing shop drawings for pool walls, gutters, floors, dike walls and balance tanks, etc. as shown on the construction drawing.

1.4 PRODUCT HANDLING

A. Delivery: Deliver materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project Site.

C. Protection: Use all means necessary to protect the swimming pool concrete before, during, and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner.

PART 2 - PRODUCTS

2.1 CONCRETE FORMWORK

A. Form Materials:
1. Form Lumber: All form lumber in contact with exposed concrete shall be new except as allowed for reuse of forms in Part 3 of this Section, and all form lumber shall be one of the following, a combination thereof, or an equal approved in advance by the Owner's Representative.
   a. "Plyform," Class I or II, bearing the label of the Douglas Fir Plywood Association; "Inner-Seal" Form as manufactured by Louisiana-Pacific.
   b. Douglas Fir-Larch, number two grade, seasoned, surfaced four sides.
2. Form Release Agent: Colorless, non-staining, free from oils; chemically reactive agent that shall not impair bonding of paint or other coatings intended for use.

B. Ties and Spreaders:
1. Type: All form ties shall be a type which do not leave an open hole through the concrete and which permits neat and solid patching at every hole.
2. Design: When forms are removed, all metal reinforcement shall be not less than two (2) inches from the finished concrete surface.
3. Wire Ties and Wood Spreaders: Do not use wire ties or wood spreaders.

C. Alternate Forming Systems: Alternate forming systems may be used subject to the advance approval of the Owner's Representative.

2.2 CONCRETE REINFORCEMENT

A. Bars: Bars for reinforcement shall conform to "Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement," ASTM A-615, Grade 60.

B. Wire Fabric: Wire fabric shall conform to "Specifications for Wire Fabric for Concrete Reinforcement," ASTM A-185.

C. Tie Wire: Tie wire for reinforcement shall conform to "Specifications for Cold-drawn Steel Wire for Concrete Reinforcement," ASTM A-82 black annealed 16-gauge tie wire.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete:
1. All concrete, unless otherwise specifically permitted by the Owner's Representative, shall be transit-mixed in accordance with ASTM C94. Concrete for water retaining structures that do not receive a waterproofing finish such as ceramic tile or swimming pool plaster shall receive a topical waterproofing finish.
2. The control of concrete production shall be under the supervision of a recognized testing agency, selected by the Owner in accordance with Section 01 25 00 of the Specifications.
3. Quality: All concrete shall have the following minimum compressive strengths at twenty-eight (28) days and shall be proportioned within the following limits:
   a. 4,000 psi minimum compressive strength for cast in place swimming pool structures.
   b. 1" maximum size aggregate.
   c. 6.0 minimum sacks of cement per cubic yard. *
   d. Maximum water to cement ratio of 0.40-0.45 maximum.
   e. 4" maximum slump.
   f. *For estimate only: to be determined by mix design.
4. Cement: All cement shall be Portland Cement conforming to ASTM C-150, Type II or V, and shall be the product of one manufacturer.

5. Aggregates:
   a. Shall conform to “Standard Specifications for Concrete Aggregates,” ASTM C33, except as modified herein.
   b. Coarse Aggregate: Clean sound washed gravel or crushed rock. Crushing may constitute not more than 30% of the total coarse aggregate volume. Not more than 5% flat, thin, elongated or laminated material nor more than 1% deleterious material shall be present. 1" aggregate graded from 1/4” to 1”, fineness modulus 6.90 to 7.40. 1-1/2” graded from ½” to 1-1/2”, fineness modulus 7.80 to 8.20.
   c. Fine Aggregate: Washed natural sand of hard, strong particles and shall contain no more than 1% of deleterious material, fineness modulus 2.65 to 3.05.
   d. Aggregate must be certified, non-expansive from a “known” good source.
6. Water: ASTM C1602Clean, fresh, free from acid, alkali, organic matter or other impurities liable to be detrimental to the concrete (potable).
7. Admixtures: Admixtures shall be used upon approval of the Owner's Representative.
   a. Air-entraining admixture: Conform to ASTM C260.
   b. Water-reducing admixture: Conform to ASTM C494.

B. Construction Joints: Use keyform for slab pour joints. Either preformed galvanized or PVC construction joint forms of a standard manufacturer may be used. Install per manufacturer's recommendations and tool edges of slabs.

C. Waterstops: PVC bulb-type for use between concrete pours / lifts, conforming with ASTM D 570, D 624, and D 638. Provide in configuration(s) as recommended by manufacturer for specific application. Greenstreak, or W.R. Meadows.

D. Curing Materials:
1. Liquid Membrane (covered slab): Chlorinated rubber membrane forming, curing-sealing compound conforming to ASTM C309.
2. Liquid Membrane (exposed slab): Clear methyl and butyl methacrylate non-staining, membrane forming, curing-sealing compound conforming to ASTM C309.

E. Cement Grout and Drypack:
1. Cement Grout: Mix 1 part by volume of Portland Cement, 1/2 part by volume of water and fine aggregate enough to make mixture flow under its' own weight.
2. Drypack: Mix 1 part by volume of Portland Cement, 1/2 part by volume of water and fine aggregate enough to make a stiff mix that will mold into a ball. Mix no more than can be used in 30 minutes.

2.4 JOINT SEALANT MATERIALS

A. Caulking: Multipart, non-sag gun grade polyurethane-based sealant meeting the requirements of ASTM C920-02, Type S or M, Mamemco International, Pecora, Sika Corp., Sonneborn Building Products, or Tremco. Self-leveling caulking materials are not allowed.

B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

C. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

D. Sealant Backer Rod: Provide compressible polyethylene or polyurethane backer rod as recommended by the sealant manufacturer.

E. Bond Breaker Tape: Provide polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.

F. Sand: Cover the surface of the caulking with #30 silica sand.

2.5 OTHER MATERIALS

A. All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the advance review by the Owner’s Representative.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to all Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that all Work may be constructed in accordance with all applicable codes and regulations, the referenced standards, the original design, and in accordance with site specific Geotechnical Report.

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive work.

3.2 CONCRETE FORMWORK

A. Construction of Forms:
1. General: Construct all required forms to be substantial, sufficiently tight to prevent leakage of concrete paste, and able to withstand excessive deflection when filled with wet concrete.
2. Layout:
a. Form for all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the Drawings.
b. Exercise particular care in the layout of forms to avoid necessity for cutting concrete after placement.
c. Make proper provisions for all openings, offsets, recesses, anchorages, blocking and other features of the Work as shown or required.
d. Perform all forming required for Work of other trades and do all cutting and repairing of forms required to permit such installation.
e. Carefully examine the Drawings and Specifications and consult with other trades as required relative to providing for pipe and conduit penetrations, reglets, chases and other items in the forms.
3. Imbedded Items: Set all required steel frames, angles, bolts, inserts and other such items required to be anchored in the concrete prior to concrete being placed.
4. Bracings:
a. Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to workmen.
b. Construct all bracing, supporting members and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
c. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.
5. Wetting: Keep forms sufficiently wetted to prevent joints from opening up before concrete is placed.

B. Plywood Forms:
1. Design: Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.
2. Joints: Make all panel joints tight butt joints with all edges true and square.

C. Footing Forms: All footing forms shall be wood unless otherwise specifically approved by the Owner's Representative, or as specified in paragraph 3.2(C)(2).

D. Reuse of Forms:
1. Reuse of forms shall be subject to advance approval of the Owner's Representative.
2. Except as specifically approved in advance by the Owner's Representative, reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
3. Except as specifically approved in advance by the Owner's Representative, reuse of forms shall in no way impart less structural stability to the forms nor less acceptable appearance to finished concrete.

E. Removal of Forms:
1. General:
a. In general, side forms of footings may be removed seven (7) days after placement of concrete, but time may be extended if deemed necessary by the Owner's Representative.

b. Forms for footings, foundations, slabs, walls, and other formed concrete may be removed fourteen (14) days after placement of concrete.

2. Removal:
   a. Use all means necessary to protect workers, passersby, the installed Work of other trades and the complete safety of the structure.
   b. Cut nails and tie wires or form ties off flush, and leave all surfaces smooth and clean.
   c. Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.
   d. Flush all holes resulting from the use of spreader ties and sleeve nuts using water, and then solidly pack throughout the wall thickness with cement grout applied under pressure by means of a grouting gun; grout shall be one-part Portland Cement to 2-1/2 parts sand; apply grout immediately after removing forms.

3.3 CONCRETE REINFORCEMENT

A. Bending:
1. General:
   a. Fabricate all reinforcement in strict accordance with the Drawings.
   b. Do not use bars with kinks or bends not shown on the Drawings.
   c. Do not bend or straighten steel in a manner that will injure the material. (When opposite end is already encased in concrete.)
2. Design:
   a. Bend all bars cold.
   b. Make bends for stirrups and ties around a pin having a diameter of not less than two (2) times the minimum thickness of the bar.
   c. Make bends for other bars, including hooks, around a pin having a diameter of not less than six (6) times the minimum thickness of the bar.

B. Placing:
1. General: Before the start of concrete placement, accurately place all concrete reinforcement, positively securing and supporting by concrete blocks, metal chairs or spacers, or by metal hangers.
2. Clearance:
   a. Preserve clear space between bars of not less than one and one-half (1-1/2) times the nominal diameter of the round bars.
   b. In no case let the clear space be less than one and one-half (1-1/2) inches nor less than one and one-third (1-1/3) times the maximum size of the aggregate.
   c. Provide the following minimum concrete covering of reinforcement:
      1) Concrete deposited against earth: three (3) inches minimum.
      2) Concrete below grade deposited against forms: two (2) inches minimum.
      3) Concrete elsewhere: As indicated on Drawings or otherwise approved by the Owner's Representative.
3. Splicing:
   a. Horizontal Bars:
      1) Place bars in horizontal members with minimum lap at splices sufficient to develop the strength of the bars.
      2) Bars may be wired together at laps except at points of support of the member, at which points preserve clear space described above.
      3) Whenever possible, stagger the splices of adjacent bars.
      4) Splice forty (40) bar diameters minimum.
      5) Provide non-contact lap slices for shotcrete.
   b. Wire Fabric: Make all splices in wire fabric at least one and one-half (1-1/2) meshes wide.
   c. Other Splices: Make only those other splices that are indicated on the Drawings or specifically approved by the Owner's Representative.
4. Dowels: Place all required steel dowels and securely anchor them into position before concrete is placed.
5. Obstructions: In the event conduits, piping, inserts, sleeves and other items interfere with placing reinforcement as indicated on the Drawings or otherwise required, immediately consult with the Owner's Representative and obtain approval of a new procedure prior to placing concrete.

C. Cleaning Reinforcement: Steel reinforcement, at the time concrete is placed around it, shall be free from rust scale, loose mill scale, oil, paint and all other coatings which will destroy or reduce the bond between

steel and concrete. Bend down all tie wire away from the top of the pool concrete. Maintain a 2" clear from top of concrete to the tie wire.

3.4 SHOTCRETE REINFORCEMENT

A. The maximum size of reinforcement shall be No. 5 bars unless it can be demonstrated by preconstruction tests that adequate encasement of larger bars can be achieved. When No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of 2-1/2 inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars uses. When two curtains of steel are provided, the curtain nearest the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.

B. Lap splices in reinforcing bars shall be by the non-contact lap splice method with at least 2 inches clearance between bars. The enforcement agency may permit the use of contact lap splices when necessary for the support of the reinforcing provided it can be demonstrated by means of preconstruction testing, that adequate encasement of the bars at the splice can be achieved, and provided that the splices are placed so that a line through the center of the two spliced bars is perpendicular to the surface of the shotcrete work.

3.5 CAST-IN-PLACE CONCRETE

A. Conveying and Placing Concrete:
1. Before placing concrete, mixing and conveying equipment shall be well cleaned, and the forms and space to be occupied by concrete shall be thoroughly cleaned and wetted. Ground water shall be removed until the completion of the work.
2. No concrete shall be placed in any unit of work until all formwork has been completely constructed, all reinforcement has been secured in place, all items to be built into concrete are in place, and form ties at construction joints tightened.
3. Concrete shall be conveyed from mixer to place of final deposit in such a way to prevent the separation or loss of ingredients. It shall be placed as nearly as practicable in its' final position to avoid rehandling or flowing. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six (6) feet. Use tremies, spouts and dump boxes in deep sections. Vibrators are not acceptable for facilitating concrete transport.
4. Concrete shall be tamped and spaded to insure proper compaction into all parts of forms and around reinforcement. A mechanical vibrator shall be used to thoroughly compact the concrete. Vibration must be by direct action in the concrete and not against forms or reinforcement.
5. Mixing and transport time as indicated in ASTM C94 is required. If air temperatures are between 85° and 90° F the delivery time is to be reduced to 75 minutes. When air temperatures are in excess of 90° F the delivery time should be reduced to 60 minutes.
6. Truck mixes without batch certificates will be rejected.

B. Construction Joints / Expansion Joints: Construction joints and expansion joints shall be provided at locations and in the manner shown on the Drawings. With exception of existing concrete / new shotcrete joints, use PVC bulb-type waterstops appropriate for design condition between all concrete pours / lifts to avoid cold joints. Waterstops shall be placed in such a way to protect reinforcing steel from rust and oxidation. All expansion joints must be the full depth of the concrete section in which they are located.

C. Slab Finishes: Concrete slabs shall be compacted and screeded uniformly to grades shown. Push large aggregates below the surface with a screen tamper, screed and bull float. As soon as the surface becomes workable, it shall be wood floated, then finished as indicated on the Drawings to a uniform smooth, true surface in a neat and workmanlike manner. Carefully coordinate slab finish requirements with other trades (ceramic tile, pool plaster) to ensure concrete finish is appropriate substrate for final finish material.
1. Pool Floor Slab: Heavy Wire Broom Finish.

D. Protection and Curing:
1. Concrete shall be protected from injurious action of the elements and defacement of any nature during construction.
2. All forms must be kept wet to prevent drying out of the concrete.
3. All concrete surfaces including footings must be kept wet for at least seven (7) days after concrete is placed.

4. Apply the appropriate curing materials, as specified in 2.3 of this Section, immediately after finishing slabs. Application shall be as specified by the manufacturer.

E. Form Removal:
1. Take care in removing forms so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.
2. No steel spreaders, ties or other metal shall project from or be visible on any concrete surfaces.

F. Defective Work:
1. Should the strength of any concrete for any portion of the work indicated by tests of molded cylinders and core tests fall below minimum 28 days strength specified or indicated, concrete will be deemed defective work and shall be replaced.
2. Concrete work that is not formed as indicated, is not true to intended alignment, not plumb or level where so intended, not true to intended grades or elevations, not true to specified or selected finish, contains sawdust shavings, wood, or embedded debris, which exhibits cracks or contains fine or coarse sulfide particles, or expansive aggregates detrimental to performance or appearance of the concrete shall be deemed defective.
3. Promptly perform work required to replace and properly clean (by sandblasting if necessary) any defective concrete panels (control joint or expansion joint to control joint or expansion joint), at Contractor's expense, including all expense of additional inspection, tests, or supervision made necessary as a result of defective concrete.

3.6 EXPANSION JOINTS

A. Temperatures: Do not install sealants when air temperature is less than 40°F.

B. Tooling: Tool exposed joints to a slightly concave surface using slicking materials recommended by the manufacturer. The tooling procedure shall press sealant against the sides of the joint. No materials shall be left “feathered” out or smeared on the abutting materials. Completed joints shall have a uniform professional appearance.

C. Joint Construction: Sealant joint width, thickness and cross-sectional profile to be constructed in strict accordance with the sealant manufacturer’s recommendations.

D. Sand: At the appropriate time cover the sealant with sand to provide a sanded finish.

3.7 CLEAN-UP

A. Upon completion of the Work of this Section, immediately remove all swimming pool concrete materials, debris and rubbish occasioned by this Work to the approval of the Owner’s Representative.

END OF SECTION

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SECTION 13 1103

SWIMMING POOL SHOTCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials and equipment as required to install wet mix shotcrete for swimming pool structures as indicated on the Drawings and herein specified.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:
   1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
   2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
   3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards: Except as otherwise indicated, provide shotcrete per American Concrete Institute Standard ACI 506. In addition, conform to recommendations contained in “Shotcrete,” Brochure G-84 as published by the Gunite Contractors Association, Sylmar, California and the International Building Code (latest edition).

C. Mix Design: The Contractor shall submit a mix design stamped and signed by a licensed engineer for approval by the Owner’s Representative prior to any placement of shotcrete. Mix design shall indicate source of aggregate and brands of cement and admixtures used. All mix designs shall take character of locally available aggregate into consideration and make adjustments as necessary to conform with specified design criteria.

D. One test panel shall be provided for each 50 yards (or portion thereof) of shotcrete placed. The size of the strength test panel shall be per the direction of the Special Shotcrete Inspector. At least three (3) cores shall be taken from each test panel. (At least three (3) cores shall be taken from the completed work for each day of shotcrete operation.) Testing shall be performed by the Owner’s designated Testing Lab and comply with 1705A.3 and 1908A.10, International Building Code. Continuous inspection of the shotcrete operation by a deputy inspector provided by the Owner shall be required. Inspection of shotcrete work shall comply with Section 1908A of International Building Code, and coring, sampling, soaking and testing per 1908A.10 and pre-construction test per 1908A.5 is required.

E. Tolerances: Construct all swimming pool shotcrete straight, true, plumb and square within a tolerance horizontally of one in 200 and a tolerance vertically of one in 2000.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 3300. Requests for substitution shall conform with requirements of Article 1.10.A of Section 13 1100.

B. Materials List: Within thirty (30) days after issuance of Notice to Proceed, and before shotcrete materials are delivered to the project site, submit to the Owner a complete list of materials proposed to be used in this portion of the Work, showing manufacturer's name and catalog number of all items such as admixtures and curing membranes, and the name and address of the supplier of cement and aggregate to be used.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect shotcrete materials before, during and after installation and to protect the installed Work specified in other Sections.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: Cement shall be Type 1 Portland Cement conforming to ASTM C150. Cement type shall be the same for all shotcrete work.

B. Aggregate: ASTM C33, washed hard dense durable clean sharp sand from approved pit, free of organic matter and opaline, feldspar, or silicous magnesium substances and containing not more than 3% by weight of deleterious substances. When tested for organic impurities by ASTM C40 method, fine aggregate color not darker than reference standard color. When tested for soundness by ASTM C88 method, loss after 5 cycles not over 10% of fine aggregate.

C. Water: Potable, clean, fresh, free from acid, alkali, organic matter or other impurities liable to be detrimental to the shotcrete.

D. Admixtures: Admixtures shall only be used upon approval of the Owner's Representative.

PART 3 - EXECUTION

3.1 EXECUTION

A. Inspection:
1. Prior to all Work of this Section carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that items to be imbedded in shotcrete are in place and that shotcrete may be placed to the lines and elevations shown on the Drawings, with all required clearance from reinforcement.

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive the Work.

3.2 PREPARATION

A. General:
1. Thoroughly clean all areas where shotcrete is to be placed to insure proper bonding of shotcrete.
2. Where shotcrete is to be placed against smooth surfaces (i.e., cast-in-place concrete), sandblast surfaces to receive shotcrete to provide clean aggregate surface, thereby insuring proper bond between materials.

B. Ground Wires: Adequate ground wires, to be used as screeds, shall be installed to establish the thickness and surface planes of the shotcrete work. Ground wires shall be placed so that they are tight and true to line and grade and in such a manner that they can be easily tightened.

3.3 PROPORTIONING AND MIXING

A. Accurately control proportion of water to Portland cement to produce thorough and uniform hydration of the shotcrete that, when shot, forms a homogeneous mass containing neither sags nor dry sand formation.

B. Shotcrete shall have a minimum compressive strength of 4,000 PSI at 28 days. Shotcrete material shall have a water/cement ratio of 0.40-0.45 per ACI 506R, Chapter 6, Proportioning and Preconstruction Testing; Section 6.3.3, Wet Mix Process.

C. Discontinue shotcrete work if the time between the addition of mixing water to cement and aggregate, or cement to aggregates, and placement of shotcrete exceeds ninety (90) minutes when the ambient temperature is below 85 degrees Fahrenheit, or exceeds sixty (60) minutes when the ambient temperature is above 85 degrees Fahrenheit.

3.4 SHOTCRETE PLACING, FINISHING, AND CURING

A. Operations: Utilize a standard type of air compressor, capable of providing a minimum of 250 cubic feet of air per minute per nozzle.

B. Placing: Except when shooting reinforcing, hold the nozzle perpendicular to and 2-1/2 to 3 feet from surface. At reinforcing bars, hold the nozzle so as to direct shotcrete behind the bars, and shoot each side of each bars separately. A nozzleman’s helper equipped with an air jet shall precede the nozzle and blow out rebound or sand lodged behind bars, on forms, or placed shotcrete. Placing shotcrete horizontal

members from the top is not allowed unless approved methods are employed to eliminate all rebound. Material shall emerge from the nozzle in a uniform flow. If flow becomes intermittent for any reason, direct the nozzle away from the surface until the flow is again steady and constant. Do not reuse rebound or loose sand for any purpose.

C. Puddled Shotcrete: Use of “puddled shotcrete” in which the air pressure is reduced and the water content is increased to facilitate placing in difficult locations is not allowed. Do not place shotcrete where nozzle stream cannot impinge directly on the involved surface. Where difficult shooting conditions occur, obtain proper results by maintaining correct air pressure and water ratio and reduce supply of material.

D. Construction Joints: Form joints with sloping beveled edges. Clean and dampen the hardened joint surfaces before placing additional shotcrete. Square edged construction joints are not allowed. The film of laitance which forms on the surface of the shotcrete shall be removed within approximately two hours after application by brushing with a stiff broom. If this film is not removed within two hours, it shall be removed by thorough wire brushing or sand blasting. Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.

E. Finishing: Rod exposed surfaces to true planes and lines on reaching the thickness and plane established by forms and ground wires. Tamp and wood float surfaces level and provide a rough raked finish. Carefully coordinate finish requirements with other trades (ceramic tile, pool plaster) to insure shotcrete finish is appropriate substrate for final finish material.

F. Curing: Keep shotcrete continuously damp for not less than seven (7) days after placing. Use sealed curing sheeting or other approved curing method where water curing is not feasible. Do not use curing compound of any kind.

3.5 DEFECTIVE WORK

A. Cut out, remove and replace, or repair to the satisfaction of the Owner’s Representative, shotcrete not meeting minimum strength, not true, plumb or level, not to required elevations, containing cracks detrimental to performance or appearance, containing shavings, debris or with honeycombs or voids.

B. Promptly perform Work required to repair, patch, replace, render properly cleaned surfaces (by sandblasting if necessary) or otherwise make good any defective shotcrete at Contractor's expense, including all expense of additional inspection, tests, or supervision made necessary as a result of defective shotcrete.

3.6 CLEAN-UP

A. Upon completion of the Work of this Section, immediately remove all swimming pool shotcrete materials, debris and rubbish occasioned by this work to the approval of the Owner's Representative.

END OF SECTION

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SECTION 13 1104

SWIMMING POOL CERAMIC TILE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Swimming pool ceramic tile detailed on the Drawings, including, but not limited to, the following:
   1. Waterline Face Tile / Transfer Tier Exterior Vertical Tile
   2. Depth Marker Tile. (At Waterline)
   3. Depth / Caution Marker. (At Pool Deck)
   4. Trim Tile (At Underwater Steps / Benches)
   5. Waterline Face Tile (at top of spa)

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:
   1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
   2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
   3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards: In addition to complying with all pertinent codes and regulations:
   1. Manufacture of all tile shall be in accordance with ANSI A-137.1.
   2. Install ceramic tile in accordance with the recommendations contained in the 2021 “Handbook for Ceramic Tile Installation” of the Tile Council of America, Inc.

C. Tolerances: Install all swimming pool ceramic tile straight, true, plumb and square within a tolerance horizontally of one in 200 and a tolerance vertically of one in 500. Waterline and gutter bullnose tile shall be level to 1/8” (+/- 1/16”) around entire perimeter of swimming pools.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the project requirements.

B. Samples: Submit samples of each color and pattern in the specified groups. Character samples can be representative for review prior to screening of actual tile.

C. Master Grade Certificate: Prior to opening ceramic tile containers, submit a Master Grade Certificate, signed by the manufacturer of the tile used and issued when the shipment is made, stating the grade, kind of tile, identification marks for the tile containers, and the name and location of the Project.

D. Specifications: Submit manufacturers recommended installation specifications for the Work.

E. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer’s original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.

C. Protection: Use all means necessary to protect swimming pool ceramic tile before, during and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner’s Representative

PART 2 - PRODUCT

2.1 TILE

A. Waterline Face Tile / Transfer Tier Exterior Vertical Tile:

1. Material: All waterline face tile shall be glazed ceramic tile (Group III standard) as manufactured by Dal-Tile or approved equal. Contact Kylee Midura kylee.midura@daltile.com (858) 344-0019.
2. Size: 1 x 1 inch
3. Color: Mosaic blend of Dal-Tile 30% #D-169 'Waterfall', 30% #D-161 'Urban Putty', 40% #D-014 'Desert Gray' (Verify color selection with Owner prior to ordering)

B. Depth Marker Tile (At Waterline):
1. Material: All depth marker tile shall be glazed ceramic tile as manufactured and/or distributed by Dal-Tile, Precision Tile Co., or approved equal.
2. Size: 6 x 6 inches.
3. Color: Dal-Tile #D-014 'Desert Gray' with 'Black' silk screen numbers.

C. Depth / Caution Marker (On Deck):
1. Material: Sandblast text into precast coping to a depth of 1/8" max, and fill with contrasting color epoxy flush with finish surface. Text font style and epoxy color to be approved by Owner prior to installation. Final location of markers to be approved by Owner prior to installation. Color as specified by Owner.

D. Trim Tile (At Underwater Steps / Benches)
1. Material: Group 3 quality, frost proof non-slip unglazed ceramic mosaic tile with absorption rate of less than 1% as manufactured by Dal-Tile or approved equal.
2. Size: 1 x 1 inches with S-812 quarter round; Dal-Tile # D-311 'Black'.

E. Waterline Face Tile (at top of spa):
1. Material: Group 3 quality, frost proof non-slip unglazed ceramic mosaic tile with absorption rate of less than 1% as manufactured by Dal-Tile or approved equal.
2. Size: 1 x 1 inches
3. Color: Color to be selected by Owner. #C-701 at hand hold. Quarter round tile at transfer tier.

2.2 MORTAR

A. Laticrete 3701 fortified mortar #LCR-37-1017.

B. Site mortar mix shall comply with ASTM C270 standards:
1. Sand for Mortar: Comply with requirements of fine aggregate for concrete.
2. Cement: Type I Portland Cement, conforming to ASTM C150.
3. Hydrated Lime: Conforming to ASTM C206 or 207, Type S.
4. Water: From a potable source.

C. Water from potable source.

D. Mortar shall meet ASTM C270 standards.

2.3 THIN SET MORTAR

A. Laticrete 254 Platinum. Laticrete, Custom or equal.

B. Water: From a potable source.

C. Mortar shall meet ASTM C627.

2.4 GROUT

A. All tile grout shall be waterproof grout complying with the recommendations of referenced standards. Grout color shall be grey for dark backgrounds, white for light backgrounds (verify colors with Architect).

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:
1. Prior to all Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that ceramic tile can be installed in accordance with the original design and all referenced standards.

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive its Work.

3.2 INSTALLATION

A. Method:
1. Install all ceramic tile in strict accordance with installation method P601-90 of the 2021 Handbook for Ceramic Tile Installation of the Tile Council of America, Inc.
2. Be certain to install all ceramic tile perfectly level, flush, plumb, and to the finish grades and elevations indicated on the Drawings.

B. Interface:
1. Carefully establish and follow the required horizontal and vertical elevations to insure proper and adequate space for the work and materials of other trades.
2. Coordinate and cooperate as required with other trades to insure proper and adequate interface of ceramic tile Work with the Work of other trades.

3.3 GROUTING

A. Follow grout manufacturer's recommendations as to grouting procedures and precautions.

B. Remove all grout haze, observing grout manufacturer's recommendations as to use of acid and chemical cleaners.

3.4 EXTRA STOCK

A. Provide one (1) unopened box of extra tile for 2.1A, and 2.1D for Owner use at a future time.

3.5 CLEAN-UP

A. Upon completion of the swimming pool ceramic tile installation, thoroughly clean and polish the exposed surfaces of tile work. Completely clean work area of debris and rubbish occasioned by this Work and dispose of to the approval of the Owner's Representative.

END OF SECTION

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SECTION 13 1105

SWIMMING POOL PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Swimming pool plaster and waterproofing of swimming pool structures as indicated on the Drawings and herein specified.

B. Start-up and operation instructions to Owner's operations and maintenance personnel and properly balance swimming pool water chemistry until the Owner takes occupancy.

1.3 QUALITY ASSURANCE

A. Qualifications of Workers:
   1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
   2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
   3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards: Swimming pool plaster shall conform with requirements of the International Building Code, latest edition. In addition, meet requirements of applicable portions of most current edition of the "Technical Manual," National Plasterers Council, Mission Viejo, California.

C. Start-up:
   1. Furnish a swimming pool water chemistry consultant, with a minimum of five (5) years experience, possessing either AFO (Aquatic Facility Operator) or CPO (Certified Pool Operator) certification(s), to supervise and properly balance swimming pool water chemistry.
   2. Demonstrate to the Owner's Representative that all systems are fully operational and that calcium hardness, total alkalinity, chlorine residual and pH levels are within specified limits.
   3. Standards: Furnish labor and chemicals as required to condition the water properly to the following specifications:
      a. Calcium Hardness: 200 - 400 parts per million (PPM)
      b. Total Alkalinity: 80 - 100 PPM, minimum
      c. Chlorine Residual: 1.00 to 2.00 PPM
      d. pH Factor: 7.2 to 7.6

1.4 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 3300.

B. Submit proof of qualifications as specified in Article 1.2.A and 1.2.C.1 of this Section.

1.5 PRODUCT HANDLING

A. Delivery: Deliver materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project Site.

C. Protection: Use all means necessary to protect the swimming pool plaster before, during, and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative.

1.6 ENVIRONMENTAL CONDITIONS

A. No plastering shall be done under unsuitable conditions of weather or temperature. No plastering shall be done when prevailing temperature is 40 degrees Fahrenheit or less.

B. Do not install plaster during rain and, if rain commences after plastering has begun, immediately protect the plaster from rain by all means necessary until the plaster has set.

C. Do not install plaster during wind greater than 10 mph and, if wind commences after plastering has begun, immediately protect the plaster from wind by all means necessary until the plaster has set.

PART 2 - PRODUCTS

2.1 CEMENT

A. Luna Quartz® tiny pebble finish by Wet Edge Technologies. Altima® quartz finish by Wet Edge Technologies. Pebble-Fina® pool finish by Pebble Technologies.

2.2 COLOR

A. All swimming pool plaster shall be white in color. Wet Edge Technologies shall be Luna Quartz® “Polar White”. Wet Edge Technologies shall be Altima® “White”. Pebble Technology shall be Pebble-Fina® “Classico”. Contractor to obtain written approval on selected pebble color from the local Health Department prior to installation. Submit cut sheet, color sample and written approval for review by Architect and Owner.”

2.3 WATER

A. Water for swimming pool plaster shall be clean and free from injurious amounts of acid, alkali, and organics.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:
1. Prior to Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation can properly commence.
2. Verify that swimming pool plaster can be installed in accordance with the original design and all referenced standards, including proprietary application techniques and application training/certifications

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive the Work.

3.2 INSTALLATION OF POOL PLASTER

A. Outdoor Pools or Spas:
1. Completion of other work: DO NOT commence plastering of swimming pool(s) or spa(s) until the following conditions have been met:
a. The Health Department and/or other governing agencies have approved the pool(s) and/or spas) for plaster.
b. All concrete pool deck construction is complete and the pool decks have been thoroughly cleaned.
c. All landscaping in areas adjacent to the pool(s) or spa(s) is complete and the landscape irrigation system is operable.
d. All painting in the pool area is complete.
e. All welding and grinding in locations adjacent to the pool area are complete.
f. The backwash sewer connection is complete.
g. Pool(s) and/or spa(s) area(s) perimeter fencing installation is complete.
h. All trash and debris have been removed from areas adjacent to the pool(s) or spa(s), particularly those areas that are normally upwind from the pool(s) or spa(s).

i. All dust raising construction and/or activities in areas adjacent to the pool(s) or spa(s) are complete or mitigated.
j. The circulation pump(s) is/are operational.
k. The mechanical system has been flushed sufficiently to remove all dirt and debris from the piping system.
l. All necessary chemicals (Chorine, pH adjuster, Sodium Bicarbonate and Calcium Chloride or any other required chemicals) are on site and ready for use.
m. Obtain written approval from the Owner's Representative and the Architect.

B. Indoor Pools or Spas:
1. Completion of Other Work: DO NOT commence plastering of swimming pool(s) or spa(s) until the following conditions have been met:
a. The Health Department has approved the pool(s) and/or spa(s) for plaster.
b. All work above the pool(s) and/or spa(s) is complete.
c. All painting in the pool area is complete.
d. All welding and grinding in locations adjacent to the pool area are complete.
e. The backwash sewer connection is complete.
f. All concrete pool deck construction is complete and the pool decks have been thoroughly cleaned.
g. The circulation pump(s) is/are operation.
h. The mechanical system has been flushed sufficiently to remove all dirt and debris from the piping system.
i. All necessary chemicals (Chlorine, Acid, Sodium Bicarbonate and Calcium Chloride) are on site and ready to use.
j. Obtain written approval from the Owner's Representative and the Architect.

C. Contractor accepts all liability from damage done to the pool plaster if the pool(s) or spa(s) is (are) plaster before the completion of the above listed items or without the written approval of the Owner's Representative and the Architect.

D. POOL PLASTER AUTHORIZATION FORM:
1. The pool(s) and or spa(s) at Addison Athletic Center is/are hereby approved for the installation of the pool plaster. Pursuant to the requirements of specification section 13 1105, paragraph 3.3.

Owner	Date
Architect / Project Manager	Date

E. Preparation:
1. Do not apply plaster over dirt, rust, scale, grease, moisture, scuffed surfaces or conditions otherwise detrimental to the formation of a durable plaster finish.
2. Consult with manufacturer on application to specific surfaces being treated. Follow manufacturer's recommendation for curing of cast-in-place concrete or shotcrete surfaces prior to application of plaster.
3. Protect ceramic tile, decking, deck equipment, gratings, fittings and other items by suitable covering or masking.
4. Mask or remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in place not to receive pool plaster. Following completion of plaster for each space or area remove masking. Re-install all removed items utilizing workers skilled in the trades involved.

F. Application:
1. Finish shall be applied to a uniform thickness of 3/8" to ½" over the entire surface. The walls shall be scratch-coated followed by a finish coat. Material applied to the floor after the walls have been applied shall be accelerated to assure uniform setting time throughout the pool surface.
2. Float the plaster to a uniform plane and trowel to a smooth, dense, impervious surface using extreme care to avoid stains.
3. Take special care in finishing around pool fittings, making sure to mask off or plug openings so as not to fill such openings with excess plaster. Be certain to completely enclose pool fittings with plaster to insure a leak-proof seal around pipes, fittings, lights, anchors, etc.

4. Accurately interface with the finish planes of items installed by other trades
5. Quartz and pebble plaster finish is to be applied by a licensed applicator as approved by the manufacturer, and in accordance with manufacturer's training.

3.3 CURING

A. Preparation: Anticipate the need for required equipment and have all such equipment immediately available for use upon completion of pool plastering.

B. Pool Filling:
1. After the plaster has sufficiently dried and before drying has proceeded to a damaging point, cure the plaster by gradually filling the pool with water, preventing all damage to finished plaster surfaces.
2. Flow the water continuously until the pool is filled.
3. When the weather is hot and/or water pressure is low, keep the pool walls damp while the pool is filling.
4. Coordinate with Contractor to ensure that the pool is continuously monitored while filling to prevent overfill.

3.4 EQUIPMENT ACTIVATION

A. All water chemistry and filtration mechanical equipment shall be operational upon filling of pool after plaster. Chemicals and other related support items as supplied by Contractor, shall be in supply at start-up.

B. For the first fourteen (14) calendar days after completion of the pool plaster, brush all plastered surfaces at least twice a day and coordinate with General Contractor to ensure that the plaster is carefully maintained after the initial fourteen-day period. In addition, coordinate with the Contractor to ensure that pool filtration equipment is continuously running during the initial fourteen-day period.

C. Start-up and provide qualified personnel to operate pool equipment for a period not less than fourteen (14) days after the pool is placed in operation, or until the Owner takes occupancy of the facility or letter of substantial completion. During this time, Contractor shall instruct and supervise the Owner's personnel in the various operating and maintenance techniques involved. Contractor shall be responsible for supply of chemicals during this not less than fourteen (14) day period and at time of turnover to Owner, chemical storage tanks shall be full. (Owner's personnel shall be fully trained and capable of assuming swimming pool maintenance tasks, training may begin before Owner takes occupancy).

3.5 CLEAN-UP

A. Upon completion of swimming pool plaster, remove all materials, equipment and debris occasioned by this Work and leave the job site in a clean and presentable condition. Perform all such clean-up to the approval of the Owner's Representative.

3.6 WARRANTY

A. All applicators must provide a minimum of five (5) year warranty for application and workmanship additional to the manufacturer's warranty for product.

END OF SECTION

SECTION 13 1106

SWIMMING POOL EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Swimming pool equipment items required for this Work as indicated on the Drawings and specified herein.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:
   1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
   2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years' experience with the materials and methods specified.
   3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years' experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. All equipment supplied or work performed shall comply with regulations governing public swimming pools and spas as contained within the International Building Code, latest edition.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 3300.

B. Required submittals include:
   1. Swimming Pool Safety Equipment, Maintenance Equipment and Fittings as specified in Article 2.1, 2.2 and 2.3 of this Section.
   2. Swimming Pool Deck and Mechanical Equipment as specified in Article 2.4 through 2.18 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

D. The equipment shown on the plans represent the first listed items in the technical specifications. The Contractor shall be responsible for all required field coordination and installation of any approved equal product to provide a fully working and warranted system. The Contractor shall submit detailed shop drawings for any products used other than the first listed specified items. Contractor provided shop drawings shall include details and quality equal to the original plans and construction documents. The Contractor shall provide any and all required engineering including but not limited to structural and anchorage requirements for any proposed equipment other than the first listed specified equipment. The Contractor is responsible to provide a factory certified representative(s) to start-up and provide on-site training for all swimming pool mechanical equipment provided.

1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect swimming pool equipment items before, during and after installation and to protect the installed work specified in other Sections.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative.

PART 2 - PRODUCTS

2.1 SAFETY EQUIPMENT

A. First Aid Kit for 50 Persons: Kiefer, United Industries, or approved equal. Quantity as required by the Department of Health, one (1) minimum.

B. Rescue Tubes and Life Ring Buoy, U.S. Coast Guard Approved: Kiefer, United Industries, or approved equal. Quantity as required by the Department of Health, one (1) minimum.

C. Throw Rope for use with Rescue Tubes: Kiefer, United Industries, or approved equal. Quantity as required by the Department of Health, one (1) minimum.

D. Rescue Hooks, 16' long x 1-1/2" aluminum pole and stainless-steel mounting hardware: Kiefer, United Industries, or approved equal. Quantity as required by the Department of Health, one (1) minimum.

E. Pool Safety Signs: As required by the Department of Health. Submittal required. Placement at the pool site shall be in conformance with Health Department Inspector. one (1) minimum.

2.2 FITTINGS

A. Main Drain / Jet Suction Frame & Grate: (9" x 9") 'Lawson Aquatics' Super Sump, Model #MLD-SG-0909, two (2) required, 32" channel drain): 'Aquastar' Model #32CDFL101 frame, grate, and sump, two (2), four (4) required. 'Hayward' 1-1/2" collector tubes #SP1056 and "Hayward' 1-1/2" hydrostatic relief valves #SP1055, two (2) required. Contractor shall provide to the Owner a Certificate of Compliance, signed by a licensed design professional, for main drain sump(s) and frame(s) and grate(s), as required by the Virginia Graeme Baker Act.

B. Hydrotherapy Spa Underwater Lights and Niches Complete: 'J & J Electronics' LPL-F5W-120-100P, one (1) required. Stainless steel niches, Pentair, #78210600 with 1" hubs, or approved equal.

C. Junction Box for Underwater Lights: Hydrel #1719, Appleton, or approved equal. One (1) required.

D. Wall Return Inlet 1-1/2" Adjustable: Swimquip #8429, Hayward #1419-B or approved equal. Three (3) required.

E. Surface Skimmer: Waterway #540-6350, 2", one (1) required.

F. Spa Hydrotherapy Jets: 'Waterway' #2123440, or Anzen #7 7/16" orifice, or approved equal. Seven (7) total.

2.3 DECK EQUIPMENT

A. Hand Rails: Paragon custom, sized per plans, 1.90" O.D. x .065" wall, two (2) required, no known equal.

B. Anchor Sockets for Hand Rails: KDI-Paragon 1.90" O.D. custom, no known equal. Four (4) required.

C. Escutcheon Plates for Hand Rails, and Grab Rails: KDI-Paragon 1.90" O.D. custom, no known equal. Four (4) required.

D. Transfer Tier Handrail: SR Smith ADA bent transfer rail #EB-16A with flanges. 1.50 O.D x 0.120" wall. Type 316L polished stainless steel. Two (2) total.

2.4 CHILDREN'S POOL TOY

A. Waterplay Twist N Spill 2 #0010-1818 with play phase anchor. One (1) total. Provide footing and connections per Detail.

2.5 HYDROTHERAPY SPA CIRCULATION PUMP

A. 'Pentair' Whisperflo WFE-3 1HP, 208-230V 1PH, self-priming pump, 3450 RPM rated at 60 GPM at 60 ft. TDH, with integral strainer. One (1) total. (41 lbs.)

2.6 HYDROTHERAPY SPA BOOSTER PUMP

A. 'Pentair' WhisperfloXF #SFK-12, 3HP, 208-230V self-priming pump, rated at 165 GPM at 55 ft. TDH, with integral strainer. One (1) total. (60 lbs.) Coordinate mountain location to maintain desired clearances.

2.7 HYDROTHERAPY SPA FILTER

A. 'Pentair' Triton #TR-100 hi rate permanent media filters with 4.91 sq. ft. of filter area rated at 74 GPM at 74 GPM/sq. ft. complete with 2" pre-manufactured multi-port valve, 2" backwash, seismic anchorage. Provide all utilities, piping, valving, etc. One (1) total. (665 lbs.)

2.8 HYDROTHERAPY SPA ULTRA VIOLET SYSTEM

A. 'Evoqua #WF-115-3-N, 1.5 kw with a 20A breaker, rated at 242 GPM at 40 mJ/cm^2, 208V-240V 1PH (148 lbs.). Complete with controller 21" x 31" x 12" deep, 110 lbs. Install per manufacturer's instructions.

2.9 SWIMMING POOL ULTRA VIOLET SYSTEM

A. 'Evoqua #WF-115-3-N, 1.5 kw with a 20A breaker, rated at 242 GPM at 40 mJ/cm^2, 208V-240V 1PH (148 lbs.). Complete with controller 21" x 31" x 12" deep, 110 lbs. Install per manufacturer's instructions.

2.10 HYDROTHERAPY SPA HEATER

A. 'Coates' TR series corrosion resistant #32018TR, 208V, 18 kw, 48 amp, 1 ½" water influent/effluent connections, copper-nickel tank, titanium heating element. One (1) total. (44 lbs.). The clearances

upstream and downstream from the rate of flow indicator shall comply with manufacturer's installation specifications. Placed after the heaters to verify recirculation flow rate is not impeded by the heaters. A fixed thermometer is mounted in the spa recirculation line downstream of the heater outlet line connection. Note: Thermometers mounted on heater outlets do not meet this requirement.

2.11 HYDROTHERAPY SPA SALT WATER GENERATION SYSTEM

A. 'Chlorking' Chlor 7.5SM, 7.5 lbs/day capacity, electrolytic process hydrochlorous acid reverting to sodium chloride, 208-240V, 20 amp, NEMA 3R enclosure, 0.5% salinity operational level, installed in accordance with manufacturer's recommendation.

2.12 HYDROTHERAPY SPA ACID STORAGE / FEED SYSTEM

A. Provide 'ChemTainer' 30 gallon #TC3448 DC; dual storage containment tank with lid seismically restrained; operating weight = (1250 lbs.) Complies with Fed. Reg. #40CFR-264-163. Provide EKO3 15-gallon acid vapor recovery system.

2.13 HYDROTHERAPY SPA WATER CHEMISTRY CONTROLLER

A. Provide one (1) dedicated ethernet connection for 'Prominent' DCM5 #1080774 water chemistry controller packages for pH, ORP and PPM with CYA stabilized water features VFD control and interface. One (1) total.

2.14 HYDROTHERAPY SPA WATER LEVEL CONTROL

A. Niche mounted 'PEM' #L104-46 wall mounted sensor unit with #L104-100A, 115V UL listed control panel, solenoid valves, etc. Spa = 3/4" fill, one (1) total.

2.15 LIESURE POOL ULTRA VIOLET SYSTEM

A. 'Evoqua #WF-115-3-N, 1.5 kw with a 20A breaker, rated at 242 GPM at 40 mJ/cm^2, 208V-240V 1PH (148 lbs.). Complete with controller 21" x 31" x 12" deep, 110 lbs. Install per manufacturer's instructions.

2.16 CHILDREN'S POOL ULTRA VIOLET SYSTEM

A. 'Evoqua #WF-115-3-N, 1.5 kw with a 20A breaker, rated at 242 GPM at 40 mJ/cm^2, 208V-240V 1PH (148 lbs.). Complete with controller 21" x 31" x 12" deep, 110 lbs. Install per manufacturer's instructions.

2.17 WATER CHEMISTRY CONTROLLER

A. 'Blue/White' F-300, hydrotherapy spa = 2" line size.

2.18 BACKWASH PIT

A. Existing below grade backwash tank.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:
   1. Prior to installing the items of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
   2. Verify that the swimming pool equipment items may be installed in strict accordance with original design, pertinent codes and regulations, and the manufacturers' recommendations.

B. Discrepancies:
   1. In the event of discrepancy, immediately notify the Owner's Representative.
   2. Do not proceed with installation in areas of discrepancy until all such discrepancies are fully resolved.
   3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Installer of existing conditions as fit and proper to receive its Work.

3.2 INSTALLATION

A. Supply and install items of swimming pool equipment in strict accordance with applicable codes and regulations, the original design, and the manufacturer's published recommendations, anchoring firmly and securely for long life under hard use.

B. Coordinate with other trades to insure all imbedded items are set plumb and flush. Railing ends must have anchor sockets and escutcheon plates. Be certain that deck equipment and railings are properly bonded prior to imbedding.

C. All equipment shall be braced and/or anchored to resist a horizontal force acting in any direction using the criteria shown on the Drawings.

3.3 INSTRUCTION

A. Upon final inspection and approval of the Owner's Representative, carefully instruct the Owner's maintenance and operations personnel in the proper operation and maintenance of installed equipment.

3.4 CLEAN-UP

A. Upon completion of swimming pool equipment, remove all debris, materials and equipment occasioned by this Work to the approval of the Owner’s Representative.

END OF SECTION

SECTION 13 1107

SWIMMING POOL MECHANICAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Swimming pool mechanical piping as indicated on the Drawings for circulation and filtration systems, pool water heating systems, chemical control systems, booster pump systems and appurtenances.

B. Domestic water system from points of connection within swimming pool mechanical equipment room to make-up water system.

C. Filter backwash piping to point of connection with backwash pit as required.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:
   1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
   2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
   3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:
   1. All equipment supplied or work performed shall comply with the International Building Code, latest edition.
   2. Work shall be performed in accordance with the applicable editions of all National, State and local codes, laws, regulations and ordinances, including the following:
      a. American National Standards Institute (ANSI).
      b. American Society for Testing Materials (ASTM).
      c. American Waterworks Association (AWWA).
      d. American Welding Society (AWS).
   3. Do not construe anything in the Drawings or Specifications to permit Work not conforming to these requirements.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 3300.

B. Required submittals include:
   1. Pipe and Fittings as specified in Article 2.2 of this Section.
   2. Valves as specified in Article 2.3 of this Section.
   3. Pressure / Vacuum Gauges as specified in Article 2.4 of this Section.
   4. Pipe Hangers and Supports as specified in Article 2.5 of this Section.
   5. Sleeves and Waterstops as specified in Article 2.6 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.

C. Protection: Use all means necessary to protect swimming pool mechanical items before, during and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

1.5 JOB CONDITIONS

A. Cooperate with entities performing Work specified in other Sections to so that no conflict of new construction or occupied space may occur. Should any installation Work be done without such craft coordination, that Work so installed shall be removed and re-installed.

PART 2 - PRODUCTS

2.1 PRODUCT QUALITY

A. Materials and equipment shall be new, of the best quality for the purpose intended, and shall be clearly marked with the manufacturer's name and nameplate data or stamp and rating. As far as practicable, materials and equipment shall be of one manufacturer.

2.2 PIPE AND FITTINGS

A. PVC Schedule 40: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be white. Dura, Lasco, or approved equal.

B. PVC Schedule 80: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be gray. Dura, Lasco, or approved equal.

C. CPVC Schedule 80 Influent/Effluent Heater Piping: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be gray. Dura, or Lasco.

D. PVC DR25: Conforming to ATSM D-1784, use with epoxy coated bell and spigot-type fittings or epoxy coated mechanical joint by flange adapters with epoxy coated cast iron fittings as specified in Article 2.02 (F), below. Johns-Manville "Big Blue", Diamond Plastics, or approved equal.

E. Copper Tubing: ASTM Specification B 88, hard drawn, with ANSI Standard B16.22 wrot copper fittings.

F. Steel: ASTM Specification A-120, Schedule 40 black or galvanized pipe with ASTM A-47 150 lb. banded malleable iron threaded fittings.

G. Cast Iron: ASTM Specification B16.1, cast iron flanged fittings, provide epoxy coating as required for use with chlorinated water.

2.3 VALVES

A. Ball Valves:
1. For pool system: True-Union design, PTFE seat material with FPM or FKM Double O-ring stem seals, locking handle, NSF certified. PVC schedule 80 body for below grade installation. PVC Schedule 80 body for above grade installation. Furnish ball valves on all pip diameters 2 ½" or less with a rating of at least 200psi at 73° F, Asahi, Ipex, or Nibco.
2. For copper pipe system: 3-piece full-port Bronze body valve with Teflon seat, 'Apollo', 'Nibco' or approved equal.

B. Butterfly Valves:
1. Epoxy coated cast or ductile iron body, 316 stainless steel disc and stem, viton seat material, furnish hand wheel/gear operators on all valves 8" and larger. DeZurick, Keystone, Ipex or equal.
2. PVC body, PVC disc and EPDM construction suitable for chlorinated water applications. Stem shall be of 316 stainless steel and non-wetted. Valves shall be self-gasketed design with a convex sealing arrangement. Valves 1-1/2" – 10" shall be rated to 150 psi and 12" valves shall be rated to 100 psi at 70°F. Asahi Pool-Pro, no known equal.

C. Check Valves: Wafer-type, epoxy coated cast or ductile iron body, 316 stainless steel plates and shaft, viton seat material. Centerline, Metraflex, or approved equal.

D. RP Backflow Preventer: Febco #835-B for 2" and smaller; #825 for 2-1/2" and larger. Febco, Watts, or approved equal.

2.4 PRESSURE / VACUUM GAUGES

A. Furnish and install pressure and vacuum gauges on the discharge and suction sides of all pumps 2-2½" dial, bottom connection, chrome ring and shut-off cock and snubber. Ranges shall be selected to indicate between mid-point and two-thirds of maximum range under design conditions. Marsh, Trerice, or approved equal.

2.5 PIPE HANGERS AND SUPPORTS

A. General

1. The requirements of this Section relates to various requirements of the Agreement, General and Supplementary Conditions, Specifications, Drawings, and modifying documents which are part of the Construction Contract. Responsibility for coordination of all such applicable requirements will be that of the Contractor.

B. Description:
1. This section provides guidelines and limitations for the support of all mechanical, electrical, plumbing or architectural items from the building structure, and for the seismic bracing of such items.
2. Design and install all support and bracing systems as required for the swimming pool systems. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design these systems to not overstress the building structure.

C. Quality Assurance:
1. Design and install all support systems to comply with the requirements of the International Building Code, Chapter 16A.
2. Seismic bracing is to be designed by a professional engineer licensed in the State of Texas.
3. For the seismic bracing of mechanical, electrical and plumbing system, refer to “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems” by Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA) for guidelines.

D. Submittals:
1. Submit shop drawings for all substructures and attachment methods.
2. Submit proposed alternative methods of attachment for review and approval by the Architects, prior to deviating from the requirements given below.
3. For all pipe hangers and support systems, submit structural calculations and details which include all resultant forces applied to the building structure and are prepared and signed by the Contractor’s licensed Texas professional engineer. Calculations will be reviewed for compliance with design criteria, not for arithmetic.

E. Materials:
1. Use Kin-Line, Grinnel, or approved equal.
2. Support all pipelines individually with hangers, each branch having at least one hanger. Lateral brace as noted and required.
3. Support piping near floor with steel stanchions welded to end plates secured to pipe and floor.
4. Support vertical piping at each floor level. Install coupling in piping at each support. Coupling shall rest on and transmit load to support. Isolate copper from steel supports with vinyl electrician's tape around pipe and coupling.
5. Use Stoneman "Trisolator," Unistrut, or approved equal, isolators at each hanger and other support points on bare copper tubing system.
6. For PVC pipe, space hangers four (4) feet apart for pipe sizes 1" and under, five (5) feet apart for pipe sizes 1-1/4" to 2", and six (6) feet apart for pipe sizes over 2". Space hangers for horizontal pipes at a maximum of six (6) feet for copper 2" and smaller and for steel 1-1/4" and smaller; ten (10) feet for copper 2-1/2" and larger and for steel 1-1/2" and larger.
7. Size hanger rods, screws, bolts, nuts, etc., according to manufacturer's sizing charts.
8. Trapeze hangers may be used for parallel lines.
9. Use galvanized or cadmium plated hangers, attachments, rods, nuts, bolts, and other accessories in pool mechanical room, high humidity areas, or where exposed to weather. Hot dip galvanize all items which are not factory furnished. Plating for hinged movements must be done at the factory.
10. Lateral Bracing: To prevent swaying of the piping systems, provide angle iron bracing and anchor into wall or overhead framing. Piping shall be braced or anchored in such a way as to resist a horizontal force of 50% of its operating weight in any direction.
11. Do not use wire or other makeshift devices for hangers.
12. Furnish all substructures and fasteners required to comply with the limitations given below. Use material as specified in the various sections and as appropriate to their use.

F. Guidelines & Limitations:
1. Each Contractor will coordinate the load requirements from all subcontractors so that no combination of loads overstresses the building structure or exceed the limitations given below.
    a. Concrete Structure:
    b. Support all loads hung from concrete structure with cast-in-place inserts, unless drilled-in anchors are specifically approved in writing prior to placing the concrete.
    c. Concrete anchors must not penetrate into reinforcing bars. Where the anchors boring indicates the presence of reinforcing bar, patch hole with an epoxy type grout and relocate anchor 12 diameters away.

d. Individual expansion anchors cannot support any loads greater than 300 pounds or manufacturer's specified load capacity without approval.

2. Steel Structure:
   a. Hang no more than 20 pounds per metal deck rib in any span.
   b. At beams, hang all beam loads greater than 40 pounds concentric to beam, not off the flanges.
   c. Attached no loads to the beams or girders greater than the following without specific approval from the architect;
      1) Roof beams and girders: 300 pound point load or 600 pound total load for a single span.

G. Seismic Bracing:
1. Design and install seismic bracing to not ground out vibration and sound isolation systems.
2. All items of mechanical and electrical equipment 60" or more in height are to be seismically braced whether such bracing is shown or not.

2.6 SLEEVES AND WATERSTOPS

A. Provide sleeves where work of this Section passes through fire rated partitions, floors and ceilings, concrete slabs or exterior of structure. Caulk clearance space using sealant appropriate for application in conformance with manufacturer's recommendations and Title 24 of Texas Code of Regulations. 3m, Dow Corning, or approved equal. In lieu of sleeves and caulking, "Link Seal" products may be used.

B. Provide prefabricated waterstops as indicated on the Drawings at all pipe penetrations through structures containing stored water (i.e., swimming pools, balance/surge tanks, etc.) to insure leak-proof seals.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:
1. Prior to Work of this Section, carefully inspect the installed Work of other trades and verify that such work is complete to the point where this installation may properly commence.
2. Verify that items of this Section may be installed in accordance with the original design and referenced standards.

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive his work.

3.2 ABBREVIATIONS AND SYMBOLS

A. Abbreviations and symbols on the Drawings are those most commonly used. Obtain clarification from the Owner's Representative on any questionable items before bid.

3.3 GENERAL PIPING REQUIREMENTS

A. Size any section of pipe for which size is not indicated or any intermediate section erroneously shown undersized the same size as the largest pipe connecting to it. Sizes listed are nominal.

B. Cut pipe accurately to job measurements and install without springing or forcing, true to line and grade, generally square with building and/or structures and adequately supported to prevent undue stress on pipe, fittings and accessories.

C. Make changes of direction with manufactured fittings. Street ells, bushings, reducing flanges, close nipples or bending of pipe is not allowed.

D. Use great care to install piping in accordance with best practice. Plastic pipe shall be "snaked" in trenches to allow for thermal expansion.

E. All above grade, below grade and buried or imbedded PVC shall be installed using solvent weld fittings. Also, each and every fitting and pipe end shall be prepared with solvent primer. Fittings shall be joined individually and with enough time between assembly of adjacent joints to allow them to seal solidly. After joining, an even ring of primer must be visible around the entire fitting. If any fittings are installed without visible primer, the fitting shall be removed and discarded and piping recut, rechamfered, and joint made up

again using a new fitting. All procedures, methods and techniques used to make up solvent weld joints shall be in strict accordance with manufacturer's recommendations.

F. Arrange pipe and hangers to allow for expansion, contraction and structural settlement. No pipe shall contact structure except penetrations as shown on the Drawings.

G. Provide dielectric connections between copper and dissimilar metals. In copper systems, threaded piping including connections to equipment shall be brass pipe and fittings. Install dielectric connections in vertical sections of piping only.

H. Run pipe full size through shut-off valves, balancing valves, etc. Change pipe size within three (3) pipe diameters of final connection to control valves, fixtures and other equipment.

I. Provide unions or flanges at connections to equipment, on service side of valves and elsewhere as required to facilitate ease of maintenance.

J. Locate equipment shut-off valves as close to equipment as possible maintaining easy valve access.

K. Make all connections between domestic water systems and equipment or face piping with approved backflow prevention devices as required.

L. All PVC pipe exposed to direct sunlight shall be painted with two coats of Exterior Acrylic Semi-Gloss Paint, Sherwin Williams or equal. Color to be selected by Architect. Prior to painting the PVC pies, the exterior of all PVC pipes shall be wiped with Methyl Ethyl Ketone, or an approved equal, to removed glaze from the pipes.

M. The Main Drain pipe must run either level or uphill from the main drain sump, through the surge pit (if applicable) and the to the circulation pump.

3.4 TRENCH EXCAVATION AND BACKFILL

A. Excavation:
1. Excavate and backfill trenches as required for the Work of this Section. Conform with requirements of Section 13 1101.
2. The Contractor shall perform all excavation of every description and of whatever materials encountered, to the depths indicated on the Drawings or as necessary. The Contractor shall dispose of the excavated materials not required or suitable for backfill as directed, and shall perform such grading as may be necessary to prevent surface water from flowing into the trenches. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters which may accumulate in the excavated areas.

B. Trenching:
1. Excavate trenches to lines and grades as indicated on the Drawings and with banks as nearly vertical as practicable.
2. Bottoms of trenches shall be accurately graded to provide uniform bearing on undisturbed soil for the entire length of each section of pipe.
3. The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8” on either side of the pipe. The width of trench above the top of pipe may be wider if necessary.
4. Over-depth excavations shall be filled with tamped sand to required grades.
5. Excavations of five (5) feet or more in depth shall be shored or supported in conformance with rules, and regulations of State and Federal Governments. Shoring shall be constructed, maintained and removed in a manner to prevent caving of the excavation walls or other load on the pipe.

C. Backfilling:
1. Material for backfilling of pipes shall be approved granular material less than two (2) inches in diameter obtained from the excavation. No material of a perishable, spongy or otherwise unsuitable nature shall be used as backfill.
2. Backfilling of pipe trenches shall commence immediately after installation and testing to preclude damage to the installed pipe. Backfill around pipe shall be carefully placed so as not to displace or damage the pipe, and shall be carried up symmetrically on each side of the pipe to one foot above the top of the pipe. The material shall be carefully compacted or consolidated before additional backfill is placed.
3. Backfill above an elevation of one foot above the top of pipe in conformance with requirements of Section 13 1100. Material for balance of backfill shall be approved granular material less than six (6) inches in diameter taken from the excavation.

4. Unless otherwise indicated on the Drawings, all pipe shall have a minimum of eighteen (18) inches of cover.

3.5 GENERAL EQUIPMENT REQUIREMENTS

A. Position equipment to result in good appearance and easy access to all components for maintenance and repairs.

B. Install piping, flues, breeching and ducts so that they do not interfere with equipment access.

C. Install level, secure and out of moisture. Provide shims, anchors, support straps, angles, grouted bases, or other items as required to accomplish proper installation.

D. All screws, nuts, bolts and washers shall be galvanized, cadmium plated or stainless steel. After fabrication, hot-dip galvanize unfinished ferrous items for outdoor, below grade or other use subject to moisture.

E. Extend 1/2” Schedule 40 black steel pipe lubrication tubes from all hard-to-reach locations to front of equipment or to access points. Terminate with proper type of lubrication fitting.

3.6 VALVES AND STRAINERS

A. If no shut-off is indicated, provide ball valves at inlet connections and balance valves at outlet connections to fixtures and equipment. Provide proper valve trim for service intended.

B. Use no solder end valves unless noted otherwise; provide adapters in copper tubing systems.

C. Locate valves with stems above horizontal plane of pipe. In general, locate valves within six (6) feet of floor, out from under equipment, in accessible locations with adequate clearance around hand wheels or levers for easy operation.

D. Provide all valves, cocks and strainers, full pipe size unless indicated otherwise.

E. Provide hand wheel operators on all valves 6” and larger, under 6” lever operators may be used.

F. Provide tool operated valve with stainless steel shaft extension and 'on deck' tool operation for surge chamber butterfly isolation valve.

3.7 IDENTIFICATION OF PIPING

A. Identify each valve by a numbered brass tag with hole and brass chain mounted on valve stem or handle. Tag to be a minimum of 1” in diameter and numbers at least 1/4” high stamped into tag. Valves and plumbing lines shall be labeled clearly with the source or destination descriptions.

B. Install an identification chart in a plastic or glass framed enclosure which schematically illustrates the proper operation of all piping systems and indicates number and location of all valves and control devices within the system.

C. The direction of flow for the recirculation equipment shall be labeled clearly with directional symbols such as arrows on all piping in the equipment area. Where the recirculation equipment for more than one pool is located on site, the equipment shall be marked as to which pool the system services.

3.8 TESTS

A. Perform tests in presence of Owner’s Representative with no pressure loss or noticeable leaks.

B. Do not include valves and equipment in tests. Include connection to previously tested sections if systems are tested in sections.

C. Perform tests as follows:

System	Test Pressure	Test Medium	Duration
Skimmer Lines and Lawson Main Drain Sump Lines	20 psig	Water*	4 hours
Pool Piping	50 psig	Water*	4 hours
Pool Main Drains	30 psig	Water*	4 hours
Domestic Water	150 psig	Water*	4 hours

Never test PVC pipe or fittings with air or other gases, always use water.

3.9 PIPE MATERIAL APPLICATION

A. PVC Schedule 40: Below grade swimming pool piping and domestic water piping up to 12” line size; use standard solvent weld fittings.

B. PVC Schedule 80: Above grade swimming pool piping up to 12” line size; use solvent weld Schedule 80 or epoxy coated cast iron fittings.

C. Type L Hard Copper: Above grade domestic water piping.

D. CPVC Schedule 80; Pool Heater Piping.

E. Schedule 40 Steel: Natural gas piping.

3.10 CUTTING AND DRILLING

A. Cutting or drilling necessary for installation of Work of this Section shall be done only with approval of Owner’s Representative.

3.11 CLOSING-IN OF UNINSPECTED WORK

A. Do not cover or enclose Work before testing and inspection. Re-open Work prematurely closed and restore all Work damaged.

3.12 QUIETNESS

A. Quietness is a requirement. Eliminate noise, other than that caused by specified equipment operating at optimum conditions, as directed by Owner’s Representative.

3.13 FLUSHING OF LINES

A. Flush or blow out pipes free from foreign substances before installing valves, stops or making final connections. Clean piping systems of dirt and dust prior to initial start-up.

B. Just prior to plastering the pool, under the observations of the IOR, the pool mechanical system shall be flushed using the pool circulation pump. Circulate water through the mechanical system until the effluent water from the pool return heads runs clean.

3.14 CLEAN-UP

A. After all Work has been tested and approved, the Swimming Pool Subcontractor shall thoroughly clean all parts of the equipment installation, including all pool pipe and fittings in the pool mechanical room. Exposed parts shall be cleaned of cement, plaster and other materials and all grease and oil spots removed with solvent.

B. The Swimming Pool Subcontractor shall remove debris from the Project site. Cartons, boxes, packing crates and excess materials not used, occasioned by this work shall be disposed of to the satisfaction of the Owner’s Representative.

C. If the above requirements of clean-up are not performed to the satisfaction of the Owner’s Representative, the Owner reserves the right to order the work done, the cost of which shall be borne by the Swimming Pool Subcontractor.

END OF SECTION

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SECTION 13 1108

SWIMMING POOL ELECTRICAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials and equipment as required to install the swimming pool electrical system including but not limited to:
1. A complete and operable system of service equipment, switchboards, panelboards, conduits, switches, time clocks and wiring for power and lighting, motor control centers.
2. Junction and/or pull boxes, conduits, disconnects, starters, contactors, wiring and connection of all motors and mechanical equipment, including connection and wiring of line voltage controls associated with the mechanical systems.
3. Swimming pool underwater lighting systems.
4. Swimming pool timing system outlets and scoreboard.
5. Complete grounding system as required and shown on the Drawings.
6. Complete equipotential bonding system as required and shown on the Drawings.
7. Adjusting and preliminary operation of the completed electrical system as described in Article 3.6, A of this Section.
8. Cleaning of all completed Work and installation adjustment of all trim and decorative items.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:
1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Ordinances and Codes: Materials and construction shall conform with all applicable code requirements, including:
1. National Electrical Code, latest edition; Electrical Safety Orders of the State of Texas; Department of Industrial Relations; regulations of the State Fire Marshal; rules and regulations of the Board of Underwriters of the Pacific, UL 50, 50E and NEMA 250 rating.
2. The International Building Code, latest edition.

C. Verification of Conditions:
1. The locations shown on the Drawings are diagrammatic only and the exact finish location of equipment and materials cannot be indicated. Therefore, locations of all Work and equipment shall be verified to avoid interferences, preserve head room and keep openings and passageways clear. Changes shall be made in locations of equipment and materials which may be necessary to accomplish these purposes.

D. D. Preliminary Operations and Testing:
1. Motor driven equipment shall be tested for correct rotation and completion of all connections.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 3300. Requests for substitutions shall conform with requirements of Article 1.10.A of Section 13 1100.

B. Required submittals include:
1. Conduit and Fittings as specified in Article 2.2 of this Section.
2. Panelboards as specified in Article 2.6 of this Section.
3. Circuit Breakers as specified in Article 2.7 of this Section.
4. Motor Starters as specified in Article 2.10 and 2.11 of this Section.
5. Fuses as specified in Article 2.13 of this Section.
6. Time Clocks as specified in Article 2.14 of this Section.
7. Ground Fault Circuit Interrupters as specified in Article 2.15 of this Section.

8. NEC required corrosion resistant enclosures, cabinets and boxes as specified in Article 2.8, 2.11, 2.16 & 218 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.

C. Protection: Use all means necessary to protect swimming pool electrical materials before, during, and after installation and to protect the installed Work specified in other Sections.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Materials shall be new, in unbroken packages and bear the U.L. label of approval.

B. Equipment of one type shall be by same manufacturer. One type of equipment for classifications such as:
1. Switchboards, panels, buss duct, disconnect switches and allied items.
2. Conduit.
3. Wire.
4. Conduit fittings.
5. Fixtures of the same general type.
6. Wiring devices.

2.2 CONDUIT AND FITTINGS

A. Conduit within or under buildings or where exposed outdoors shall be rigid metal threaded, hot dipped galvanized, or U.L. approved plastic except where noted otherwise on the Drawings. Metallic conduit shall be of the same metal between outlets or terminals.

B. Use flexible metallic conduit only for short connections of motors and where specifically called for on Drawings. Maximum length shall be 40". Use only liquid tight flexible metal conduit. Install an unbroken #12 AWG insulated copper grounding conductor in each liquid tight flexible conduit with permanent connection at motor junction box and service panel ground.

C. Protect, before installation, metallic conduit runs in all slabs laid on grade or in contact with the earth or exposed in damp locations, with two (2) heavy coats of asphaltum rust-resisting compound.

D. Encase conduits 2-1/2" or larger run underground, outside, or under buildings, in concrete envelopes a minimum of 3" thick, except as indicated otherwise on Drawings or stubouts. Conduits 2 and smaller laid 18" below finish surface in soil.

E. Low voltage runs underground outside buildings, 1-1/4" or smaller, may be G.I. or sherardized steel conduit, with machine applied wrapping equal to double wrap or Scotch-Wrap #50 tape, half lapped and quadrupled at joints in lieu of concrete encasement.

F. Service conduits through foundations or concrete members shall run through metal sleeves with adequate clearances for full movement of the conduit. Do not run conduits through footings.

G. Secure conduits run exposed on surfaces with one hole heavy-duty straps or fasten with matching fittings to inserts or trapezes, parallel to building walls and ceilings.

H. Cap all conduit or duct stub-outs with standard factory caps; except cap threaded steel conduit with B.I. water pipe caps in outdoor locations.

I. Use conduit fittings as manufactured by Crouse-Hinds Company, Appleton Electric Co., or approved equal.

J. Employ U.L. liquid tight fittings for use with liquid tight flexible metal conduit.

K. Use unions as manufactured by Appleton, O-Z/Gedney, or approved equal. The use of running threads will not be permitted.

L. Exposed conduit and fittings in chemical rooms shall be nonmetallic rigid polyvinyl chloride, corrosion resistant rated suitable for installation in corrosive environments and in accordance with the latest NEC requirements.

2.3 EQUIPOTENTIAL BONDING/GROUNDING

A. A. Bond together and ground to a common ground at a single point all metallic conduit, piping systems, pool reinforcing steel, metal parts of ladders, lifeguard stands, handrails and their supports and the like. The solid copper bonding conductor shall not be smaller than #8 copper.

2.4 WIRING CONNECTIONS

A. Make connections without strain on conductors, allowing the conductors to take a natural position after connections or taps are made. Include all strand of wire in making the connection.

B. Make connections for wiring by one of the following means:
1. Make all taps or connections to conductors with compression type connectors except those smaller than #8 B&S gauge may have soldered connections. Solderless connections for #10 AWG or smaller may be used and shall be "Scotchlok", Buchanan, or approved equal. For #8 AWG or larger, they shall be T&B "LockTite", Burndy "Versitaps", or approved equal.
2. All cable or conductor terminal lugs shall be Burndy "Quicklug", Ilsco, or approved equal. Two piece stamped lugs and solder lugs will not be approved.
3. Paint taped splices in damp or outdoor locations with two (2) coats of insulating paint.
4. Tag all branch circuit wires with circuit number at the panelboard and at each point of use with linen or plastic tags.

2.5 CONDUCTORS

A. Copper RHW or THW. Do not make splices between boxes.

2.6 COLOR CODING

A. Neutrals (identified conductors shall be white).

B. Phase conductors shall be red for phase B; blue for phase C.

C. Green shall be used for mechanical equipment and receptacle grounds only.

2.7 MOTOR WIRING

A. Make final connections to motors with the required AWG (Minimum #12), Flamenol machine tool wire, 19 strand. Control wiring for equipment shall be Flamenol machine tool wire, 19 strand of required AWG. Provide corrosion resistant junction boxes at each item of equipment to change from standard building wiring to machine tool wire.

B. Phase motors as proper in direction of rotation.

2.8 PANELBOARDS

A. Panelboards shall be flush or surface mounting as indicated with circuit breakers as shown on panel schedule, hinged lockable doors, index card holders and proper bussing.

B. Where indicated on the drawings, panelboards shall be furnished with subfeed breakers and/or lugs, split bussing, contractors, time switches, relays, etc., as required.

C. All panelboards shall be keyed alike.

D. All panelboard enclosures shall be corrosion resistant rated in accordance with the latest NEC requirements.

E. Furnish corrosion resistant panelboard enclosures and terminal cabinets with Yale 46515 flush locks and LL806 keys except where indicated otherwise herein. Fasten the trim to panel boards and terminal cabinet by means of concealed, bolted or screwed fasteners accessible only when the door is open.

F. Panelboards 208/120 volt, three phase, 4 wire, S/N or 120/240 volt, single phase, 3 wire, S/N.

Panelboard types as manufactured by:

Westinghouse	Type B10B
General Electric	Type NLAB
Square D	Type NQOB

G. Panelboards for 480/277 volt, three panes, 4 wire, S/N.

Panelboard types as manufactured by:

Westinghouse	Type Pow-R-Line 2
General Electric	Type AE
Square D	Type NEHB
Sylvania	Type NH1B
I.T.E.	Type Approved Equal

H. Panelboard for bussing sizes thru 400 amp shall be 20" wide surface mounted type. Recess mounted type shall have a 20" wide (maximum) recess metal enclosure with trim plate cover extending 1" on all sides of enclosure. Depth shall be 5-3/4" nominal. Height of panel as required for devices.

I. Provide 6" additional gutter space in all panels where double lugs are required, or where cable size exceeds bus size. Minimum bottom gutter space shall be 6" high. 12" additional gutter space may be required for aluminum feeders where used.

J. Panelboards shown on the drawings with relays, time clocks or other control devices shall have a separate metal barriered compartment mounted above panel with separate hinged locking door to match panelboard. Provide mounting sub-base in cabinet for control devices and wiring terminal strips.

K. Panelboard shall have a circuit index card holder removable type, with clear plastic cover. Index card shall have numbers imprinted to match circuit breaker numbers.

2.9 CIRCUIT BREAKERS

A. Breakers shall have a minimum short circuit interrupting rating of 10,000A symmetrical for panelboard voltage thru 240 volt and 14000A for panelboards thru 600 volts or as specified on the drawings. In no case shall the interrupting rating be less than the bus withstand rating unless noted otherwise on the drawings.

B. Circuit breakers as manufactured by the following companies only are acceptable:
1. General Electric Company
2. Square D Company
3. Westinghouse Company
4. I.T.E. Company

C. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the drawings. Circuit numbers of breakers shall be black-on-white micarta tabs or other previously approved method. Circuit number tabs which can readily be changed from front of panel will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.

D. Where two or three pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.

E. All circuit breakers shall be padlockable in the "off" position. Locking facilities shall be riveted or mechanically attached to the circuit breaker (submit sample for approval). Other means of attachment shall not be accepted without prior written approval of Architect.

F. Where branch circuit breakers supply the power to motors and signal systems, the breakers shall be furnished with lockout clips, mounted in the "on" position. The breakers shall be able to trip automatically with lockout clips in place.

G. Panelboard circuit breakers shall be bolt-on type.

2.10 BUSSING

A. Bussing shall be rectangular cross section copper, or full length silver or tin-plated aluminum.

B. Bussing shall be braces to withstand symmetrical short circuit ratings as follows or as noted on drawings. In no case shall bus short circuit bracing be less than specified circuit breakers.

C. Each panelboard shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

2.11 POOL MECHANICAL EQUIPMENT ENCLOSURES, TERMINAL CABINETS & MISC CABINETS

A. All pool mechanical equipment enclosures, terminal cabinets and miscellaneous cabinets in the pool mechanical room or chemical storage rooms shall be corrosion resistant rated in accordance with the latest NEC requirements. Enclosures and all cabinets shall be flush mounted (except where noted a surface) of the size indicated on the drawings, and complete with hinged lockable doors and the number of 2-way screw terminals required for termination of all conductors. Terminal cabinet locks to operated form

same key used for panelboards. The trim to terminal cabinets shall be fastened by means of concealed bolted or screwed fasteners accessible behind door to terminal cabinets. Terminal cabinets shall have 5/8" plywood backing.

B. Provide engraved nameplate on each enclosure and cabinet indicating its designation and system (i.e., Swimming Pool - Panel 'SP').

2.12 MOTOR CONTROL INDIVIDUAL STARTERS

A. Manual Motor Starters:

1. Provide flush or surface mounting manual motor starters with number of poles and size of thermal overload heaters as required for the motor being controlled (equipped with overload heaters, one for each motor lead). Back boxes shall be supplied with all flush mounting starters whether they are toggle type requiring only a 4" square outlet box or the larger type requiring a special box and cover designed to accept the particular unit. All box types shall be corrosion resistant rated in accordance with the latest NEC requirements.
2. Unless otherwise noted on the drawings, all manual starters for single phase motors, smaller than 1 h.p., shall be the compact toggle type. Manual starters for all single phase motors, 1 to 5 h.p., and all three phase motors up to 5 h.p. shall be the heavy duty type.
3. Where manual motor starter is shown with pilot light, the pilot light shall be installed in a separate outlet box adjacent to the starter outlet, and engraved nameplate in indicate function of pilot light.
4. The following motor starters as manufactured by:

Manufacturer	**Single Phase 1HP and Below**	**Others**
Arrow Hart	Type RL	Type LL
General Electric	CR 101	Class CR 1062
I.T.E.	Class C10, C11 or C12	Class C20
Square D Company	Class 2510, Type A	Class 2510, Type B & C
Westinghouse	Type MS	Type A100
Allen Bradley	Approved Equal	Approved Equal.

B. Individual Magnetic Motor Starters:

1. Magnetic motor starters shall be A.C. line voltage, across-the-line units in a corrosion resistant rated enclosure in accordance with the latest NEC requirements.
2. All starters located outside of a building whether or not indicated shall be W.P. (weatherproof), and all starters noted W.P. shall be furnished in a corrosion resistant rated stainless steel enclosure in accordance with the latest NEC requirements.
3. Starter shall be horsepower rated for the motor controlled, and shall be equipped with properly sized overload elements. Every pole shall be with overload element.
4. Verify the exact motor current and voltage characteristics with the Contractor supplying the motor before installation of a starter.
5. Each starter shall be equipped with "Hand-Off-Auto" switch or stop-start pushbutton as required.
6. Coils shall be designed to operate on voltage indicated on control diagrams and have built-in-under the voltage release for coil circuit to drop motor starter off the line when the line voltage drops below normal operating voltage.
7. The coil control circuit shall be independently fused, sized to protect coil.
8. Starters to be equipped with running pilot light indication with a "Push-to-Test" feature.
9. Magnetic starters shall have a minimum of two auxiliary contacts. Additional auxiliary contacts shall be provided as required to comply with the requirements of the wiring diagrams on the electrical and mechanical drawings and the description of the function in the Mechanical Section of the Specifications.
10. Starters shall comply with NEMA standards, size and horsepower ratings as indicated on drawings.
11. The following types of magnetic motor starters as manufactured by:

Manufacture	**Type**
General Electric	Class CR 106
I.T.E.	Class A20
Square D Company	Class 8536
Westinghouse	Type A200 (Size 4 Max.) or Class II-200 (Sizes 5-8)

2.13 INDIVIDUAL COMBINATION MOTOR STARTERS

A. Combination starter shall incorporate fused disconnect switch and individual magnetic motor starter. Combination starters shall be mounted in a corrosion resistant rated enclosure in accordance with the latest NEC requirements.

B. Starters shall comply with NEMA standards, size and horsepower ratings as indicated on drawings General Electric, Square D, Westinghouse or I.T.E.

C. The disconnect handle used on combination starters shall control the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "ON" or "OFF", and shall include a two-color handle grip, the black side visible in the "OFF" position indicating a safe condition, and the red side visible in the "ON" position indicating an unsafe or danger condition.

D. All starters used in combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes, and horsepower ratings. These starters shall be furnished with three melting alloy type thermal overload relays.

E. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if a thermal unit is removed.

2.14 MOTOR CONTROL CENTER, INTERLOCKS AND CONTROL DEVICES

A. Refer to mechanical and plumbing drawings and specifications and provide all control devices including timeswitches, relays and interconnection of starters as required.

B. Mount all relays and timeswitches in a separate compartment in motor control center unless otherwise indicated.

C. Whether shown on mechanical and plumbing drawings or control center schedules or not, where motors are controlled by external devices (i.e., thermostats, relays, float or pressure switches, etc.) or interlocked with other motors, each motor starter to be equipped with a "Hand-Off-Auto" selector switch in starter cover. Other starters equipped with a "Start' Stop" pushbutton station in starter cover. The Contractor shall be responsible to submit a complete and detailed set of shop drawings, electrical schematic design along with electrical component cut sheets from the MCC panel or the interlock control device manufacturer. RSD Total Control: Allan Pearson 949-380-7878, South Coast Controls: Anthony Ellis 714-998-5656 or approved equal.

2.15 FUSES

A. Fuses shall be dual element, current limiting type, U.L. Class RK5 unless otherwise indicated on the drawings. Provide one spare set of fuses of each size and type in each motor control center.

2.16 TIME CLOCKS

A. Time clocks shall be provided for all underwater lighting systems and swimming pool circulation pumps not controlled by filter microprocessors.

B. Contacts shall have a minimum rating of 40 amperes at 277V.

C. Timing motor shall be heavy duty synchronous, self starting, high torque type, and shall be rated at 120, 208, 240, 277 volt 60 Hz.

D. Motor shall operate normally at temperature range of -60 degrees Fahrenheit to +120 degrees Fahrenheit.

E. Dial shall be 3" diameter, clearly calibrated with day/night zones and 24 hour rotation, with gear to provide one revolution yearly which automatically varies the on/off settings each day according to seasonal changes. Day and month of the year shall show clearly through calendar window on the dial.

F. Time clocks shall be equipped with 7-spoke omitting wheel marked with days of the week.

G. Time clocks shall be housed in a corrosion resistant rated enclosure in accordance with the latest NEC requirements.

H. Acceptable manufacturers are Intermatic, Tork, Paragon, or approved equal.

2.17 GROUND FAULT CIRCUIT INTERRUPTERS

A. Minimum rating shall be 20 amperes, 125V, 5 milliampere trip setting, Class A per UL943.

B. Manufacturer to be Crouse-Hinds, Leviton, or approved equal.

2.18 BOXES

A. Boxes shall be of the size required by ordinances or larger, must be corrosion resistant in accordance with the latest NEC requirements where concealed or exposed on ceilings or walls.

B. Outlets to be surface where wiring is exposed and flush in areas where conduit is concealed.

C. Provide surface outlets with proper corrosion resistant surface covers. Box and cover shall be deep enough to provide at least 1/4" clearance between back of device and back of box. Where box contains more than one device, use a corrosion resistant rated gang box with proper cover in accordance with the latest NEC requirements. Surface outlet boxes shall be of the threaded hub type wherever below 8'0".

D. If necessary for cable installation, additional pull boxes or junction boxes may be installed in accessible locations. Exposed pull boxes and junction boxes shall be corrosion resistant rated in accordance with the latest NEC requirements.

E. Where exposed to weather pull boxes larger than outlet boxes are required, galvanized code gauge sheet steel boxes may be used with covers attached by brass machine screws may be used. Boxes exposed to the weather shall be approved for the purpose, and conduit entrances shall be on the bottom made by means of an interchangeable hub with gasket and adapter nut. Pull boxes not shown on Drawings may be added only after approval of size and location is obtained.

F. For outlets exposed to weather or where noted, cast outlet boxes shall be Crouse-Hinds, Appleton, or approved equal. Boxes shall have proper number and size hubs. Device plates, covers, adapters and boxes shall be as manufactured by Crouse-Hinds, Appleton, or approved equal.

G. Exposed junction boxes, outlet boxes and pull boxes for pool chemical rooms shall be non -metallic suitable for a corrosive environment and in accordance with the latest NEC requirements.

2.19 IDENTIFICATION MARKINGS

A. Plainly mark all motor and electrical appliance control equipment indicating the equipment controlled with engraved metal tags.

B. Provide laminated plastic nameplates on panelboards on the outside of the door at the top indicating panel designation and feeder source.

C. Provide laminated plastic nameplates on distribution switchboards and motor control centers at the top center indicating panel designation and feeder source.

D. Identify each distribution switchboard and motor control center circuit breaker with a laminated plastic nameplate indicating its' use.

E. Type panelboard directories on the forms provided with the equipment, indicating the use of each branch circuit breaker.

F. Fasten all laminated plastic nameplates to surfaces with two (2) or more screws.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify conditions at the Project site before submitting bid. Be responsible for providing all necessary wiring for the new electrical systems. Wherever wiring is being disrupted due to remodeling or changes, reconnect existing and provide new wiring circuits to accomplish a fully operable system at no additional cost to the Owner.

3.2 COORDINATION

A. The Drawings are essentially diagrammatic and indicate the desired location, size, routes, connection points, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the Work so as to provide the best possible installation in the available space and to overcome difficulties, limitations or interference wherever encountered. Be responsible for the correct placement of this Work, the proper location and connection in relation to Work of other trades, for determining the exact location of all conduits, outlets and equipment, and for installing the conduits in such a manner as to conform to the structure, avoid obstruction, preserve headroom and keep openings and passageways clear. Particular attention is directed to the close coordination required on exposed Work. Locations shown on Architectural or Mechanical Drawings if different than those shown on Electrical Drawings should be communicated to the Owner’s Representative in writing for clarification.

3.3 INSTALLATION

A. Trenching and Backfill: Conform with requirements of Section 13 1101. Provide minimum cover as required by Code.

B. Conduit Installation:
1. Conduit and metallic raceway systems shall be mechanically and electrically continuous from sources of current to all outlets in a manner to provide a continuous grounding path. Close ends of conduit during construction to prevent entrance of dirt or moisture.
2. Securely fasten conduit to the building construction within three feet of each outlet and within every ten feet thereafter. Secure it to boxes, cabinets, pull boxes, terminals with two locknuts and ends equipped with bushings or a terminal fitting. Cut square with ends carefully reamed.
3. Make bends or elbows so that the conduit will not be injured or flattened.
4. Use insulated metallic bushings in all places where bushings are required.
5. Run exposed conduits level or plumb and parallel to the construction members of the building. No cutting across or diagonal runs will be permitted. Neatly surmount structural obstructions encountered on conduit runs by the use of fittings or pull boxes.
6. Identify feeder conduits by stamped metal tags secured to exposed section of conduit in main or sub-panels.
7. Make up all threaded conduit joints gas and watertight with conductive sealer except conduit above ground in dry indoor locations.
8. Rigidly support all boxes independently of the conduit system.

C. Connections to Equipment:
1. Fully connect, in an approved manner, all electrical outlets, apparatus, motors, equipment, fixtures, wiring devices and appliances whether they are installed under the Electrical Contract or not, which require electrical connections, to the corresponding electrical system outlet.
2. Where the Work of this Section requires connections to be made to equipment that is furnished and set-in-place under other Sections, obtain such roughing-in dimensions from the manufacturer or supplier of each item as required and assume full responsibility for the installation of the connections thereto.

3.4 ADJUSTMENT AND CLEAN-UP

A. Preliminary Operation: Should the Owner's Representative deem it necessary to operate the electrical installation or any part thereof prior to Substantial Completion of the Work, consent to such preliminary operation and supervise conduction of same. Subcontractor shall pay all costs occasioned by such operation. Preliminary operation shall not be construed as an acceptance of any Work installed under this Contract.

B. Clean-up: Upon completion of the Work of this Section, immediately remove all swimming pool electrical materials, debris and rubbish occasioned by this Work to the approval of the Owner's Representative.

END OF SECTION

SECTION 13 2416

SAUNAS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Modular saunas with convection heaters.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, sauna heater rated capacities, vapor retarder data, and accessories.

B. Shop Drawings:
1. Include plans, elevations, sections, and details.
2. Indicate dimensions, required clearances, method of field assembly, and location and size of each field connection.
3. Include locations of sauna heater, lighting, and controls.
4. Show locations and sizes of blocking and reinforcements, and attachments to other work.

C. Samples: For each exposed wood member, full board width by 12 inches (305 mm) long.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sauna heaters to include in operation and maintenance manuals.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not install saunas until building is enclosed, wet-work in spaces is complete and dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify openings and dimensions for precut saunas by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Locate concealed framing, blocking, and reinforcements that support precut saunas by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of sauna heaters that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Faulty operation of heating element, controls, and safety mechanisms.
b. Deterioration or corrosion of metals or metal finishes.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MODULAR SAUNAS WITH CONVECTION HEATERS

A. Modular Saunas with Convection Heaters: Freestanding, demountable, panelized system complete with manufacturer's standard framing, insulation, and vapor retarders; designed for use with convection heater. Include the following:
1. Basis-of-Design Product: LA Commercial Heaters; Polar LA.
2. Exterior Wall Finish: Prepared to receive gypsum board.
3. Bench.
4. Removable flooring.
5. Vulcanite sauna heater rocks.

2.2 HEATERS AND CONTROLS

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. Convection Heater: Manufacturer's standard compact electric convection unit with stainless-steel elements, stainless-steel interior, stainless-steel exterior, and wire protective top grill. Provide heat-tested, shatter-resistant igneous rocks that are in direct contact with and completely cover heating-unit coils.
1. Capacity: Determined by manufacturer for sauna size indicated.
2. Power Supply: 208 V ac, 12 KW, three phase.
3. Mounting: Floor mounted with integral floor stand or legs.

C. Digital Controls: Manufacturer's standard system designed for remote wall mounting, with touchpad controls, digital display, thermostat, and the following features:
1. Mounting: Recessed.
2. Heater switch.
3. Light switch.
4. Heat-indicator light.
5. Adjustable temperature control.
6. Programmable time and temperature for heater startup and shutdown.
7. Preset temperature lock.

2.3 COMPONENTS

A. Benches: Fabricate from S4S, 2-by-2-inch-nominal (38-by-38-mm-actual) wood, spaced not more than 1/2 inch (13 mm) apart and supported by 2-by-4-inch-nominal (38-by-89-mm-actual) wood framing; of same wood species as interior paneling.

B. Base and Trim: Same wood species and grade as interior paneling.

C. Flooring: Manufacturer's standard removable 1-by-4-inch-nominal (19-by-89-mm-actual) wood duckboards, of same species and grade as interior paneling, spaced not more than 1/2 inch (13 mm) apart and mounted on preservative-pressure-treated wood sleepers.

2.4 MATERIALS

A. Interior Paneling: 1-by-4-inch-nominal (19-by-89-mm-actual), V-joint, tongue-and-groove wood boards; sanded smooth; kiln dried to no more than 12 percent moisture content.
1. Wood Species and Grades: Lumber of grades indicated according to DOC PS 20 and the provisions of the grading agency indicated.
a. Western Red Cedar: WCLIB or WWPA; Clear Heart.

B. Fasteners: Stainless steel or hot-dip galvanized.

C. Vapor Retarder: Laminated aluminum foil and kraft-paper vapor barrier with water-vapor transmission rate of no more than 0.006 perms (0.34 ng/Pa x s x sq. m) as tested according to ASTM E 96/E 96M.

2.5 ACCESSORIES

A. Provide the following accessories. Provide wood accessories of same wood species as interior paneling unless otherwise indicated.
1. Wood guardrail for heater, of dimensions required by listing.
2. Wood-slat backrest for each bench.
3. Thermometer, 4-inch (102-mm) diameter, with chrome casing.
4. Wood light valance with low-voltage light fixture.
5. Wall-mounted light fixture, rated for damp locations; brushed satin aluminum with white glass globe.
6. Wood bucket, 1-gal. (4-L) capacity, with stainless-steel liner and wood ladle.

2.6 FABRICATION

A. Fabricate saunas to dimensions, profiles, and details indicated. Sand boards smooth and ease edges to a radius of not less than 1/16 inch (1.6 mm).

B. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, vents, 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.

C. Nail or screw and glue bench components together from bottom side.

D. Countersink or conceal all metal fasteners.

E. Secure glass in wood frames with removable stops.

F. Flush mount junction boxes for heater, control panel, and light fixtures, with concealed connecting electrical conduit in modular sauna panels.

G. Modular Saunas: Complete fabrication of modular sauna panels, including assembly and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation.
   1. Trial fit panels at fabrication shop. Install dowels, screws, bolted connectors, cam locks, and other fastening devices that can be removed after trial fitting. Verify that parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
   2. Accessible Modular Saunas: Fabricate framing and panels to eliminate thresholds and permit accessible entry.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for suitable conditions where saunas are to be installed.

B. Examine roughing-in for electrical systems to verify actual locations of electrical connections before heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition paneling to average prevailing humidity conditions in installation areas before installation.

3.3 INSTALLATION OF MODULAR SAUNAS

A. Complete field assembly with joining methods recommended in writing by manufacturer.

B. Set saunas level, plumb, and securely in place. Anchor as required for secure installation.

3.4 INSTALLATION OF PRECUT SAUNAS

A. Install sauna according to manufacturer's written instructions.

B. Install sauna components level, plumb, true, and straight with no distortions. Shim, as required, with concealed shims. Install level, plumb, and to a true plane to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96 inch (1.6 mm in 2400 mm) vertical cup or bow.

C. Install interior paneling vertically and anchor to supporting substrate with blind nailing through tongue and groove. Do not use face fastening. Install with fewest joints possible, using full-length pieces.

3.5 ADJUSTING

A. Adjust sauna door to close securely without binding. Adjust door to operate at room temperature and at sauna operating temperature.

END OF SECTION

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SECTION 21 0500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Fire-suppression equipment and piping demolition.
7. Equipment installation requirements common to equipment sections.
8. Painting and finishing.
9. Concrete bases.
10. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.
2. Escutcheons.

B. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. 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 Coordination Drawings.

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 to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast-brass type with polished chrome-plated finish.
g. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
h. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
g. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
h. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. 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.

P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. 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.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

3.4 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete or Miscellaneous Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

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SECTION 21 1000

WATER BASED FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:
   1. Wet-pipe sprinkler systems.

1.02 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.

1.03 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
B. 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 per NFPA.
   3. Minimum Density for Automatic-Sprinkler Piping Design: As per NFPA.
   4. Maximum Protection Area per Sprinkler: Per UL listing and/or NFPA.
   5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated.

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
   2. Pipe hangers and supports.
   3. Valves, including listed fire-protection valves and specialty valves and trim.
   4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
   5. Hose connections, including size, type, and finish.
   6. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
   7. Alarm devices, including electrical data.
B. Shop Drawings: Diagram power, signal, and control wiring.
C. Fire-hydrant flow test report. Report shall be no older than six (6) months from test.
D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.
E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
F. Welding certificates.
G. Field quality-control test reports.
H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional services needed to assume responsibility. Base calculations on results of fire-hydrant flow test.
    a. Professional Responsibility: Preparation of working plans, calculations, and field test reports by a qualified Texas currently licensed R.M.E.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.06 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Coordinate sprinkler head locations closely with architectural. Notably sidewall sprinklers and sprinklers located in wood ceilings.

C. Note that the Sprinkler Contractor’s work starts at the top of the riser spigot in the riser room, usually 2 feet above finish floor. Detector check valves 5’ or more from the building are by others.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.
2. For each style and temperature range required, furnish an additional two (2) fire sprinklers and concealed covers for every 100 units installed, but not less than six (6) fire sprinklers and twelve (12) concealed sprinkler covers of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. Manufacturers: All valves, retarding chambers, sprinkler heads, alarms, and similar items shall be furnished by one manufacturer for the entire project. The selected manufacturer shall be one of the following, unless otherwise indicated or approved.
    a. Reliable.
    b. Viking.
    c. Grinnell.

2.02 DUCTILE-IRON PIPE AND FITTINGS (for use at underground building entrance only)

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Gaskets: AWWA C111, rubber.

C. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.
1. Grooved-Joint Piping Systems:
a. Manufacturers:
1) Victaulic Co. of America.
2) Viking
3) Argco
4) Star
b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD.
c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.
d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing with key matching ductile-iron-pipe groove and key matching steel-pipe groove, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.
e. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

2.03 STEEL PIPE AND FITTINGS

A. All sprinkler piping shall be schedule 40 black steel pipe unless otherwise indicated or approved.

B. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and 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, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

C. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.
1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.
a. Manufacturers:
1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Ward Manufacturing.

D. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

E. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and 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) National Fittings, Inc.
4) Southwestern Pipe, Inc.
5) Star Pipe Products; Star Fittings Div.

6) Victaulic Co. of America.
7) Ward Manufacturing.

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, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.04 DIELECTRIC FITTINGS

A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.

1. Manufacturers:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Hart Industries International, Inc.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Industries, Inc.; Wilkins Div.

C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.

1. Manufacturers:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Watts Industries, Inc.; Water Products Div.

D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:
   a. Advance Products and Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.

1. Manufacturers:
   a. Calpico, Inc.
   b. Lochinvar Corp.

F. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 225 deg F.

1. Manufacturers:
   a. Perfection Corporation.
   b. Precision Plumbing Products, Inc.
   c. Victaulic Co. of America.

2.05 FLEXIBLE CONNECTORS

A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:

1. NPS 2 and Smaller: Threaded.
2. NPS 2-1/2 and Larger: Flanged.
3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Manufacturers:
   1. Anamet Inc.
   2. Flex-Hose Co., Inc.
   3. Flexicraft Industries.
   4. Flex-Pression, Ltd.
   5. Flex-Weld, Inc.
   6. Hyspan Precision Products, Inc.
   7. Mercer Rubber Co.
   8. Metraflex, Inc.
   9. Proco Products, Inc.
   10. Unaflex Inc.

C. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

D. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

E. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.06 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.07 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. Sprinkler specialty fittings shall have 250-psig minimum working-pressure rating if fittings are components of high-pressure piping system.

B. Outlet Specialty Fittings:
   1. Manufacturers:
      a. Anvil International, Inc.
      b. Central Sprinkler Corp.
      c. Ductilic, Inc.
      d. JDH Pacific, Inc.
      e. National Fittings, Inc.
      f. Shurjoint Piping Products, Inc.
      g. Southwestern Pipe, Inc.
      h. Star Pipe Products; Star Fittings Div.
      i. Victaulic Co. of America.
      j. Ward Manufacturing.
   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. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
   1. Manufacturers:
      a. Central Sprinkler Corp.
      b. Fire-End and Croker Corp.
      c. Viking Corp.
      d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
   1. Manufacturers:
      a. Elkhart Brass Mfg. Co., Inc.

b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
1. Manufacturers:
a. AGF Manufacturing Co.
b. Central Sprinkler Corp.
c. G/J Innovations, Inc.
d. Triple R Specialty of Ajax, Inc.

F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
1. Manufacturers:
a. CECA, LLC.
b. Merit.

2.08 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.

B. Gate Valves with Wall Indicator Posts:
1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with hand wheel, extension rod, locking device, and cast-iron barrel.

C. Ball Valves: Comply with UL 1091, except with ball instead of disc.
1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
3. NPS 3: Ductile-iron body with grooved ends.

D. Butterfly Valves: UL 1091.
1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

F. Gate Valves: UL 262, OS&Y type.
1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

G. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
1. Supervised valves shall have tamper switches. Supervised switches shall be prewired, double pole, single throw, with cast aluminum housing and tamperproof cover.
2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.
3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

2.09 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. Control valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.
1. 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. Pressure-Regulating Valves: UL 1468, brass or bronze, NPS 1-1/2 and NPS 2-1/2, 400-psig minimum rating. Include female NPS inlet and outlet, adjustable setting feature, and straight or 90-degree-angle pattern design as indicated.
   1. Finish: Rough metal.
C. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.
   1. Manufacturers:
      a. AFAC Inc.
      b. Grinnell Fire Protection.

2.010 MANUAL CONTROL STATIONS

A. Manual Control Stations: UL listed or FMG approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.011 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 250-psig minimum pressure rating if sprinklers are components of high-pressure piping system.
B. Automatic Sprinklers: With heat-responsive element complying with the following:
   1. UL 199, for nonresidential applications.
   2. UL 1626, for residential applications.
   3. UL 1767, for early-suppression, fast-response applications.
C. Sprinkler types, features, and options as follows:
   1. Concealed ceiling sprinklers, including cover plate (typical of all lay-in ceilings).
   2. Extended-coverage sprinklers.
   3. Flow-control sprinklers, with automatic open and shutoff feature.
   4. Flush ceiling sprinklers, including escutcheon.
   5. High-pressure sprinklers.
   6. Institution sprinklers, made with a small, breakaway projection (refer to plans for required areas).
   7. Open sprinklers.
   8. Pendent sprinklers.
   9. Pendent, dry-type sprinklers.
   10. Quick-response sprinklers.
   11. Recessed sprinklers, including escutcheon.
   12. Concealed sidewall sprinklers (typical of all sidewall sprinkler heads).
   13. Sidewall, dry-type sprinklers.
   14. Upright sprinklers.
D. Sprinkler Finishes: Chrome plated, bronze, and painted (unless noted otherwise on plans). Paint color must be approved by architect prior to order.
E. Special Coatings: Wax, lead, and corrosion-resistant paint.
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: Chrome-plated steel, 2 piece, with 1-inch vertical adjustment.
   2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Guards shall be provided in all gymnasium areas and/or as shown on drawings.

2.012 HOSE CONNECTIONS

A. Manufacturers:
   1. AFAC Inc.
   2. Central Sprinkler Corp.
   3. Elkhart Brass Mfg. Co., Inc.
   4. Fire-End and Croker Corp.
   5. Fire Protection Products, Inc.

6. GMR International Equipment Corporation.
7. Grinnell Fire Protection.
8. Guardian Fire Equipment Incorporated.
9. McWane, Inc.; Kennedy Valve Div.
10. Mueller Company.
11. Potter-Roemer; Fire-Protection Div.
12. United Brass Works, Inc.

B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle or gate pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
1. Valve Operation: Nonadjustable type, unless pressure-regulating type is indicated.
2. Finish: Rough metal or chrome-plated.

2.013 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers:
1. AFAC Inc.
2. Central Sprinkler Corp.
3. Elkhart Brass Mfg. Co., Inc.
4. Fire-End and Croker Corp.
5. Fire Protection Products, Inc.
6. GMR International Equipment Corporation.
7. Guardian Fire Equipment Incorporated.
8. Potter-Roemer; Fire-Protection Div.
9. Reliable Automatic Sprinkler Co., Inc.
10. United Brass Works, Inc.

B. Exposed, Freestanding-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body, brass inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass lugged caps, gaskets, and brass chains; brass lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high, brass sleeve; and round, floor, brass escutcheon plate with marking "AUTO SPKR & STANDPIPE."
1. Finish Including Sleeve: Rough chrome-plated

2.014 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.

C. Electrically Operated Alarm: UL 464, with 8-inch- minimum - diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.
1. Manufacturers:
a. Potter Electric Signal Company.
b. System Sensor.

D. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

E. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.

F. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

G. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

2.015 PRESSURE GAGES

A. Manufacturers:
1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Brecco Corporation.
4. Dresser Equipment Group; Instrument Div.
5. Marsh Bellofram.
6. WIKA Instrument Corporation.

B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.
1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14, and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.

B. Report test results promptly and in writing. Sprinkler Flow calculations shall be done within 6 months (or sooner if required by local AHJ) of the date of the flow test.

3.02 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.03 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. 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.

D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

E. Underground Service-Entrance Piping: Ductile-iron, grooved-end pipe and fittings; grooved-end-pipe couplings; and grooved joints. Include corrosion-protective encasement.

3.05 SPRINKLER SYSTEM PIPING APPLICATIONS Note: All materials used must have approval from local AHJ.

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
1. NPS 2 and Smaller: Pipe smaller than 2 ½” shall have malleable iron threaded fittings.

2. NPS 2-1/2 and Larger: Pipe larger than 2 ½" shall be welded or cut groove (no pressed groove) with style 77 heavy duty clamps.

3.06 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 ball, butterfly, or gate valves.

3.07 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 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. Copper Tube: Roll-groove tubing. Use grooved-end fittings and grooved-end-tube couplings.
   4. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.
F. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
   1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
   2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
   3. NPS 5 and Larger: Use dielectric flange insulation kits.

3.08 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building.
B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.
C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.09 WATER-SUPPLY CONNECTION

A. Connect fire-suppression piping to building's water supply. See plans for point of connection. Refer to Division 22 Section "Domestic Water Piping" for interior piping.
B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water supply piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.010 PIPING INSTALLATION

A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.
B. Fire suppressions systems must have their own supports directly from the structure above and not from any other building element. Run piping at or near the bottom chord of structural framing to be free of other systems.

C. 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 Architect before deviating from approved working plans.
D. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.
E. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
F. 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.
G. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
H. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
I. Install sprinkler piping with drains for complete system drainage.
J. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
K. Install drain valves on standpipes.
L. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain/sink.
M. Install alarm devices in piping systems.
N. Hangers and Supports: Comply with NFPA 13 for hanger materials.
O. 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.
P. Fill wet-pipe sprinkler system piping with water.

3.011 VALVE INSTALLATION

A. 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.
B. Valves for Wall-Type Fire Hydrants: Install nonrising-stem gate valve in water-supply pipe.
C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
D. Specialty Valves:
   1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.
E. All valves shall be color coded and over-painted to identify each zone controlled.

3.012 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:
   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: Concealed sprinklers.
   3. Wall Mounting: Concealed sidewall sprinklers.
   4. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.
   5. Sprinkler Finishes:
      a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

b. Concealed Sprinklers: Rough brass, with factory-painted cover plate. Coordinate cover plate cover with architect.
c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
e. Residential Sprinklers: Dull chrome.

3.013 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.

3.014 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install freestanding-type, fire department connections in level surface.
1. Install protective pipe bollards on three sides of each fire department connection. Refer to Division 05 Section "Metal Fabrications" for pipe bollards.
B. Install ball drip valve at each check valve for fire department connection.

3.015 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment to allow service and maintenance.
C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain/sink.
E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
F. Electrical Connections: Power wiring is specified in Division 26.
G. Connect alarm devices to fire alarm.
H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.016 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14.

3.017 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. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Energize circuits to electrical equipment and devices.
4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
5. Verify that equipment hose threads are same as local fire department equipment.
B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.018 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.
B. Remove and replace sprinklers with paint other than factory finish.
C. Protect sprinklers from damage until Substantial Completion.

3.019 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

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SECTION 22 0500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Plumbing demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.8 AS-BUILT DRAWINGS

A. DEFINITIONS

1. Contractor Markups – Drawings that are marked and annotated to show the project As-Built and constructed by the contractor. They are part of the working as-built set.
2. As-Built Drawings – The amended "As-designed" drawing revised to show the project as the contractor built and constructed it. The revisions from Contractor Markups and field inspection notes are transferred to the Final as-built set of drawings. The final as-built drawings include modifications during construction, field requested changes, shop drawing modifications, and contractor designs,

B. DESCRIPTION OF WORK

Section includes: Administrative and procedural requirements for as-built process for contractor to follow.

C. RECORD DOCUMENT SUBMITTALS

Record As-Built Drawings: General Contractor shall maintain on-site 2 sets of as-built Contract Drawings, in Contractor Field Office. Working as-built drawings shall be kept current on a weekly basis and at least one paper set of as-built drawings shall be available on the jobsite at all times. Note that MEPCE will not provide plumbing CAD files to the Contractor.

a. Changes to Drawings, including those that involve only narrative, shall be clearly and neatly marked in red pen or pencil, and shall be noted on appropriate drawings. Changes to the Contract Drawings include:

   1. Changes to material or equipment for substitutions approved through the Architect/Engineer's submittal process.
   2. Where contract drawings or specifications show options or alternates, only the option selected for construction shall be shown on the final as-built prints. Cross out such words and phrases as "approved equal" and list specifically the material provided. This shall include actual make and model number of equipment installed, as well as voltage and MCA.
   3. Shop drawing information.
   4. RFIs and Change Order information.
   5. Changes made by the Inspector to accommodate field conditions.
   6. Actual location, kinds and sizes of all existing and new utility lines, especially underground lines within the construction area. Measurements shall be shown for all change of direction points and all surface or underground components such as valves, manholes, drop inlets, clean outs, meters, etc.
   7. Changes in location of equipment and architectural features.
   8. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler and irrigation systems.
   9. All construction changes that result from the final inspection.

b. General Contractor shall note each entry with a notation referencing source of information (Example: RFI #94, CO #3, or field notes of same).
   1. As-built record drawings shall be updated no less frequently than once per week.
   2. Verification of current as-built record drawing status is included in the monthly payment approval process that shall be noted in the inspector's log notes.
   3. Individual(s) responsible for the verification of the as-built process shall be identified to the Architect/Engineer.

c. When completed, scanned pdf copies of the as-built drawings shall be sent to the Owner and Architect/Engineer for final approval. Compliance and delivery of the final as-built drawings will be enforced through the approval of progress payments. The quality of the final as-built drawings will be reflected in the construction contractor's performance evaluation.

D. MARK-UP GUIDELINE

The following information is provided to improve the quality of the marked-up prints and thereby facilitate preparation of final as-built drawings. The most important guideline is that the marked-up changes on the prints shall be complete and understandable.

1. Frequently use written explanation on As-Built drawings to describe changes. Do not rely totally on graphic means to convey the revision.
2. Legibility of lettering and digit values shall be clean and clear and readable from a scanned copy.
3. Whenever a revision is made, make changes to affect related section views, details, legend, plans and elevation view, schedules, notes and call-out designations, and mark accordingly to avoid conflicting data on all other sheets.
4. When changes are required on small-scale drawings or on drawings with limited area available, large-scale inserts shall be drawn or sketched, with leaders to the location where applicable.
5. When attached prints (or sketches) are provided with marked-up print, indicate whether:
    a. Entire drawing shall be added to contract drawings or
    b. Whether the contract drawings shall be changed to agree, or
    c. For reference only to further details not required for initial design.
6. Make the comments on the drawing complete without reference to letters, memo's or materials that are not also a part of the As-Built. For instance, do not just say, "As per Change Order #12", when the actual change order states, "Changed water pipe from 2-1/2" to 3". This also applies for changes as per the Architect/Engineer, Owner or Inspector.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.
g. Or approved equal.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2) and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and/or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Eslon Thermoplastics.
b. Or approved equal.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Thompson Plastics, Inc.
b. Or approved equal.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and/or PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
   1. Available Manufacturers:
      a. NIBCO INC.
      b. NIBCO, Inc.; Chemtrol Div.
      c. Or approved equal.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

   1. Available Manufacturers:
      a. Cascade Waterworks Mfg. Co.
      b. Fernco, Inc.
      c. Mission Rubber Company.
      d. Plastic Oddities, Inc.
      e. Or approved equal.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

   1. Available Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company.
      c. Eclipse, Inc.
      d. Epco Sales, Inc.
      e. Hart Industries, International, Inc.
      f. Watts Industries, Inc.; Water Products Div.
      g. Zurn Industries, Inc.; Wilkins Div.
      h. Or approved equal.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

   1. Available Manufacturers:
      a. Capitol Manufacturing Co.
      b. Central Plastics Company.
      c. Epco Sales, Inc.
      d. Watts Industries, Inc.; Water Products Div.
      e. Or approved equal.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

   1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.
e. Or approved equal.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.
c. Or approved equal.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Available Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.
e. Or approved equal.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.
e. Or approved equal.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. 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 Coordination Drawings.

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 to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type with spring clips.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
   g. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips..

h. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips..
i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
g. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
h. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
i. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. 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.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. 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.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi , 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete,or Miscellaneous Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.10 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 22 0519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.

B. Related Sections:
1. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.
2. Division 23 Section "Facility Natural-Gas Piping" for gas meters.

1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
5. Or approved equal.

B. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter.

C. Element: Bourdon tube or other type of pressure element.

D. Movement: Mechanical, connecting element and pointer.

E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

F. Pointer: Red metal.

G. Window: Glass.

H. Ring: Brass.

I. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

J. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.

K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 REMOTE-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Marsh Bellofram.
4. Miljoco Corp.
5. Palmer - Wahl Instruments Inc.
6. REO TEMP Instrument Corporation.
7. Tel-Tru Manufacturing Company.
8. Trerice, H. O. Co.
9. Weiss Instruments, Inc.
10. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
11. Winters Instruments.

B. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter with holes or bracket for panel mounting.

C. Element: Bourdon tube or other type of pressure element.

D. Movement: Mechanical, connecting element and pointer.

E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

F. Pointer: Red metal.

G. Window: Glass.

H. Ring: Brass.

I. Connector: Bottom or Back union type.

J. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.

K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 BIMETALLIC-ACTUATED DIAL THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Ernst Gage Co.
3. Eugene Ernst Products Co.
4. Marsh Bellofram.
5. Miljoco Corp.
6. NANMAC Corporation.
7. Noshok, Inc.
8. Palmer - Wahl Instruments Inc.
9. REO TEMP Instrument Corporation.
10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.

C. Case: Dry Liquid-filled type, stainless steel with 5-inch diameter.

D. Element: Bimetal coil.

E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

F. Pointer: Red metal.

G. Window: Glass.

H. Ring: Stainless steel.

I. Connector: Adjustable angle type.

J. Stem: Metal, for thermowell installation and of length to suit installation.

K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.4 THERMOWELLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Marsh Bellofram.
5. Miljoco Corp.
6. NANMAC Corporation.
7. Noshok, Inc.
8. Palmer - Wahl Instruments Inc.

9. REO TEMP Instrument Corporation.
10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.5 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. KOBOLD Instruments, Inc.
6. Marsh Bellofram.
7. Miljoco Corp.
8. Noshok, Inc.
9. Palmer - Wahl Instruments Inc.
10. REO TEMP Instrument Corporation.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-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 metal.
7. Window: Glass.
8. Ring: Brass.
9. Accuracy: Grade A, plus or minus 1 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. Remote-Mounting, Dial-Type Pressure Gages: ASME B40.100, indicating-dial type.

1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter with holes for panel mounting.
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 metal.
7. Window: Glass.
8. Ring: Brass.
9. Accuracy: Grade A, plus or minus 1 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.

D. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.6 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

B. Minimum Pressure and Temperature Rating: 150 psig at 200 deg F .

C. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200 deg F shall be CR.
2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install thermometers in the outlet of each domestic, hot-water storage tank. Install to be easily visible without using a ladder.

B. Install thermometers at suction and discharge of each pump.

C. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions with 1-degree scale divisions
2. Domestic Cold Water: 30 to 130 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

B. Install pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.

C. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

D. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

E. Install remote-mounting pressure gages on panel.

F. Install needle-valve and snubber fitting in piping for each pressure gage.

G. Install test plugs in tees in piping.

H. Install permanent indicators on walls or brackets in accessible and readable positions.

I. Install connection fittings for attachment to portable indicators in accessible locations.

J. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.

K. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION

SECTION 22 0523

GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following general-duty valves:

1. Bronze angle valves.
2. Copper-alloy ball valves.
3. Bronze check valves.
4. Cast-iron plug valves.

B. Related Sections include the following:

1. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and charts.
3. Division 22 piping Sections for specialty valves applicable to those Sections only.

1.2 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. TFE: Tetrafluoroethylene plastic.

1.3 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.4 QUALITY ASSURANCE

A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

    a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE ANGLE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 2, Bronze Angle Valves with Nonmetallic Disc:

    a. American Valve, Inc.
    b. Cincinnati Valve Co.
    c. Crane Co.; Crane Valve Group; Crane Valves.
    d. Crane Co.; Crane Valve Group; Jenkins Valves.
    e. Crane Co.; Crane Valve Group; Stockham Div.
    f. Grinnell Corporation.
    g. Hammond Valve.
    h. NIBCO INC.
    i. Powell, Wm. Co.

C. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy handwheel.

D. Type 2, Class 125, Bronze Angle Valves: Bronze body with nonmetallic disc and union-ring bonnet.

E. Type 2, Class 150, Bronze Angle Valves: Bronze body with nonmetallic disc and union-ring bonnet.

F. Type 2, Class 200, Bronze Angle Valves: Bronze body with nonmetallict disc and union-ing bonnet.

2.4 COPPER-ALLOY BALL VALVES

A. All ball valves shall be two-piece full port with threaded ends and stainless-steel ball and stem:

B. Manufacturers:

1. Two-Piece, Copper-Alloy Ball Valves:

    a. Conbraco Industries, Inc.; Apollo Div.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. DynaQuip Controls.
    f. Flow-Tek, Inc.
    g. Grinnell Corporation.
    h. Hammond Valve.
    i. Honeywell Braukmann.
    j. Jamesbury, Inc.
    k. Jomar International, LTD.
    l. Kitz Corporation of America.
    m. Legend Valve & Fitting, Inc.

n. Milwaukee Valve Company.
o. Nexus Valve Specialties.
p. NIBCO INC.
q. R & M Energy Systems (Borger, TX).
r. Red-White Valve Corp.
s. Richards Industries; Marwin Ball Valves.
t. Watts Industries, Inc.; Water Products Div.

C. Copper-Alloy Ball Valves, General: MSS SP-110.

D. Two-Piece, Copper-Alloy Ball Valves: Forged-brass body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

E. Safety-Exhaust, Copper-Alloy Ball Valves: Two-piece bronze body with exhaust vent opening, chrome-plated ball with vent, blowout-proof stem, locking handle, and working pressure rating for compressed air of at least 125 .

2.5 BRONZE CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 2, Bronze, Horizontal Lift Check Valves with Nonmetallic Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Walworth Co.

2. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Red-White Valve Corp.

3. Type 2, Bronze, Vertical Lift Check Valves with Nonmetallic Disc:

a. Grinnell Corporation.
b. Kitz Corporation of America.
c. Milwaukee Valve Company.

4. Type 3, Bronze, Swing Check Valves with Metal Disc:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.
j. Milwaukee Valve Company.
k. NIBCO INC.

l. Powell, Wm. Co.
m. Red-White Valve Corp.
n. Walworth Co.
o. Watts Industries, Inc.; Water Products Div.

5. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. McWane, Inc.; Kennedy Valve Div.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Red-White Valve Corp.
k. Walworth Co.
l. Watts Industries, Inc.; Water Products Div.

C. Bronze Check Valves, General: MSS SP-80.

D. Type 2, Class 125, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

E. Type 2, Class 125, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

F. Type 2, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

G. Type 2, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

H. Type 2, Class 200, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

I. Type 2, Class 200, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

J. Type 3, Class 125, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

K. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

L. Type 3, Class 200, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

M. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

N. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

O. Type 4, Class 200, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.6 CAST-IRON PLUG VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Lubricated-Type, Cast-Iron Plug Valves:

    a. Milliken Valve Co., Inc.
    b. Nordstrom Valves, Inc.
    c. Olson Technologies; Homestead Div.
    d. R & M Energy Systems (Tomball, TX).
    e. Walworth Co.

2. Nonlubricated-Type, Cast-Iron Plug Valves:

    a. General Signal; DeZurik Unit.
    b. Grinnell Corporation.
    c. Mueller Flow Technologies.
    d. Tyco International, Ltd.; Tyco Valves & Controls.
    e. Wheatley Gaso, Inc.
    f. Xomox Corporation.

C. Cast-Iron Plug Valves, General: MSS SP-78.

D. Class 125 or 150, lubricated-type, cast-iron plug valves.

E. Class 250 or 300, lubricated-type, cast-iron plug valves.

F. Class 125 or 150, nonlubricated-type, cast-iron plug valves.

G. Class 250, nonlubricated-type, cast-iron plug valves.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

    1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate, gate, or plug valves. Note that only gate valves shall be used on main pipe lines in order to avoid water hammer.
2. Throttling Service: Angle, ball, butterfly, or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

C. Low-Pressure, Compressed-Air Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two or Three-piece, 150-psig CWP rating, copper alloy.
2. Equipment-Isolation Ball Valves, NPS 2 and Smaller: Safety-exhaust, bronze.
3. Ball Valves, NPS 2-1/2 and Larger: Class 300, ferrous alloy.
4. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
5. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
6. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.
7. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
8. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
9. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type I, II or III, Class 250, cast iron.
10. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
11. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 250, NRS bronze-mounted cast iron.
12. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
13. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 250, bronze-mounted cast iron.

D. Domestic Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 250, cast iron.
3. Ball Valves, NPS 2 and Smaller: Two or Three-piece, 150 CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 and Larger: Class 300, ferrous alloy.
5. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
6. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.
8. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig rating.
9. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
10. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type I or II, Class 250, cast iron.
11. Gate Valves, NPS 2 and Smaller: Type 1, Class 150, bronze.
12. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 250, NRS, bronze-mounted cast iron.
13. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
14. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 250, bronze-mounted cast iron.
15. Plug Valves, NPS 2 and Larger: Class 250 or 300, nonlubricated-type, cast iron.
16. Resilient-Seated, Eccentric Plug Valves, NPS 3 and Larger: 175-psig CWP rating, cast iron.

E. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded ends.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or grooved type ends.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End, Copper Tubing and Steel Piping: Valve ends may be grooved.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

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.

3.5 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 0529

HANGERS AND SUPPORTS FOR PLUMBING PIING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. 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, including pipe stands, 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.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.
5. Pipe positioning systems.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

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 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 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers: Similar to MSS Type 1, steel pipe hanger except hanger is made of fiberglass and continuous-thread rod and nuts are made of polyurethane or stainless steel.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Champion Fiberglass, Inc.
c. Cope, T. J., Inc.; Tyco International, Ltd.
d. Seasafe, Inc.
e. Unistrut Corp.; Tyco International, Ltd.
f. Wesanco, Inc.

B. Strap-Type, Fiberglass Pipe Hangers: Made of fiberglass loop with stainless-steel continuous-thread rod, nuts, and support hook.

1. Available Manufacturers:

a. Plasti-Fab, Inc.
b. Lee Composites, Inc.
c. Century Composites

2.5 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.

2.6 FIBERGLASS STRUT SYSTEMS

A. Description: Shop- or field-fabricated pipe-support assembly, similar to MFMA-3, made of fiberglass channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Champion Fiberglass, Inc.
3. Cope, T. J., Inc.; Tyco International Ltd.
4. Seasafe, Inc.

2.7 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: 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.

2.8 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. Note: Obtain written permission from Structural Engineer, Architect or Owner before using these fasteners on structural members.

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 stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Note: Obtain written permission from Structural Engineer, Architect or Owner before using these fasteners on structural members.

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.

2.9 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Available Manufacturers:

a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.
c. Portable Pipe Hangers.

2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Available Manufacturers:

a. Portable Pipe Hangers.

b. PHP System Design

2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.10 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Available Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.11 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.12 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. 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 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-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.
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 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 2 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 20, 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 not necessary.
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 not necessary.
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.

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.
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.

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-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

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. 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 absorb 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 absorb 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 absorb 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.

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 (with permission) instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

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. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. 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.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

I. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

J. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

L. 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.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. 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.

O. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. 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.

Q. 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.

    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 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.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

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. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.3 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch or Stainless steel, 0.025-inch- or 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. 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. In addition, provide equipment make, model and serial number, voltage, mca, cfm or gpm (as applicable), manufacture date. NOTE THAT MANUFACTURER'S STAMPED NAMEPLATE WILL NOT BE SUFFICIENT.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) 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 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, size and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. 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.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: 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. Fasteners: Brass wire-link or wire link chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 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. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting or “High-Performance Coatings."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. 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.

D. Pipe Label Color Schedule:

1. Low-Pressure, Compressed-Air Piping:

a. Background Color: Blue.
b. Letter Color: White.

2. Medium-Pressure, Compressed-Air Piping:

a. Background Color: Blue.
b. Letter Color: White.

3. Domestic Water Piping:

a. Background Color: Green.
b. Letter Color: White.

4. Sanitary Waste Vent and Storm Drainage Piping:

a. Background Color: Green.
b. Letter Color: White.

5. Natural Gas Piping:

a. Background Color: Yellow.
b. Letter Color: Black

6. Condensate, gravity or pumped Piping: Note: designate whether gravity or pumped.

a. Background Color: Green.
b. Letter Color: White.
.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches round.
b. Hot Water: 1-1/2 inches round.
c. Low-Pressure Compressed Air: 1-1/2 inches round.
d. High-Pressure Compressed Air: 1-1/2 inches round.

2. Valve-Tag Color:

a. Cold Water: Green.
b. Hot Water: Green.
c. Low-Pressure Compressed Air: Blue.
d. High-Pressure Compressed Air: Blue.

3. Letter Color:

a. Cold Water: White.
b. Hot Water: White.
c. Low-Pressure Compressed Air: White.
d. High-Pressure Compressed Air: White.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

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SECTION 22 0700

PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
   a. Flexible elastomeric.
   b. Mineral fiber.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.

B. Related Sections include the following:

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 23 Section "HVAC Insulation."

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

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. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers,

attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.

F. Application Schedule: Provide schedule of intended application for each product indicated. Schedule to include pipe system, pipe size, insulation material, and insulation thickness for each application.
1. Example application schedule (Note: sizes and materials listed are examples only. Refer to specifications Part 2 – Products and Part 3 – Execution for full description of required materials.)

PIPE SYSTEM	PIPE SIZE	INSULATION MATERIAL	INSULATION THICKNESS
Domestic Cold Water	All Pipe Sizes	Flexible Elas-tomeric	1/2"
Domestic Hot Water	NPS 1-1/4" and smaller	Mineral-Fiber	1"
Domestic Hot Water	NPS 1-1/2" and larger	Mineral-Fiber	1-1/2"
Condensate Drain	All Pipe Sizes	Flexible Elas-tomeric	3/4"
Roof Drain	All Pipe Sizes	Flexible Elas-tomeric	1"

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. 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.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 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 C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ

or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Commercial Board.
    b. Fibrex Insulations Inc.; FBX.
    c. Johns Manville; 800 Series Spin-Glas.
    d. Knauf Insulation; Insulation Board.
    e. Manson Insulation Inc.; AK Board.
    f. Owens Corning; Fiberglas 700 Series.

I. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; FBX.
    b. Johns Manville; 1000 Series Spin-Glas.
    c. Owens Corning; High Temperature Industrial Board Insulations.
    d. Rock Wool Manufacturing Company; Delta Board.
    e. Roxul Inc.; Roxul RW.
    f. Thermafiber; Thermafiber Industrial Felt.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000(Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket with factory-applied ASJ or with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, 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. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-97.
b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
c. Marathon Industries, Inc.; 290.
d. Mon-Eco Industries, Inc.; 22-30.
e. Vimasco Corporation; 760.

C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 81-33.

D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

F. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 97-13.

G. 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. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

H. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Red Devil, Inc.; Celulon Ultra Clear.
e. Speedline Corporation; Speedline Vinyl Adhesive.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F .
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; Encacel.
b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
c. Marathon Industries, Inc.; 570.
d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.

4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.

2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-70.
b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.

c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F.
6. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

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. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76.

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 C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, 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. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto PVC Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and Kraft paper.

d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper 2.5-mil-thick Polysurlyn.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

a. Factory cut and rolled to size.
b. Material, finish, and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and Kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and Kraft paper 2.5-mil-thick Polysurlyn.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

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 C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.

c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

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 lb f/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. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.

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. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

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: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.

2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products; Bands.
    b. PABCO Metals Corporation; Bands.
    c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) AGM Industries, Inc.; CWP-1.
        2) GEMCO; CD.
        3) Midwest Fasteners, Inc.; CD.
        4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) AGM Industries, Inc.; CWP-1.
        2) GEMCO; Cupped Head Weld Pin.
        3) Midwest Fasteners, Inc.; Cupped Head.
        4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
        2) GEMCO; Perforated Base.
        3) Midwest Fasteners, Inc.; Spindle.

    b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    c. Spindle: Copper- or zinc-coated, low carbon steel, aluminum or 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.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

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.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
2) GEMCO; Press and Peel.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, aluminum or 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.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel, aluminum, or 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. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of 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: 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.

2.10 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, 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 B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends 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 pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

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 over compress 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 galvanized steel, at least 0.040 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.
4. As an alternate (hot fluid only) provide removable blanket with Velcro or snap fasteners for pump insulation.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, 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.

C. 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.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as 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.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time.

Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.10 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

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.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect 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, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 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 in paragraphs below that is not factory insulated.

C. Domestic hot-water pump insulation shall be one of the following:

1. Fiber Glass: 1.5 inches thick.
2. Mineral-Fiber Board: 1.5 inches thick and 2-lb/cu. ft. nominal density.

D. Domestic hot-water storage tank insulation shall be one of the following:

1. Mineral-Fiber Board: 1.5 inches thick and 2-lb/cu. ft. nominal density.
2. Mineral-Fiber Pipe and Tank: 1.5 inches thick.

E. Domestic cold water storage tank insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.

F. Piping system filter-housing insulation shall be one of the following:

1. Flexible Elastomeric: 1 inches thick.

3.13 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Sanitary Waste drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.14 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. All pipe sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1/2 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1-1/2 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1/2 inch thick (minimum). Larger if otherwise specified for specific piping applications.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Condensate and Equipment Drain Water:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Flexible Elastomeric: 3/4 inch thick.

H. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

I. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

3.15 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Flexible Elastomeric: 1 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch thick.

3.16 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Chilled and Heating Water, All Sizes: Prefab, pre-insulated steel pipe with foam insulation and PVC jacket. See plans.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. This does not apply for equipment with factory-applied insulation and jacket. For factory applied insulation and jacket, no further field work is required.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:

1. None.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
1. PVC: 30 mils thick.
2. Aluminum, Corrugated: 0.020 inch thick.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
1. Aluminum, Corrugated 0.032 inch thick.

F. Piping, Concealed:
1. All Service Jacket.

G. Piping, Exposed:
1. PVC: 20 mils thick.
2. Aluminum, Stucco Embossed: 0.020 inch thick.

3.18 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over field installed insulation material.

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, Corrugated: 0.020 inch thick.
3. Painted Aluminum, Corrugated: 0.016 inch thick.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Corrugated with Z-Shaped Locking Seam: 0.020 inch thick.
2. Stainless Steel, Type 304 or 316, Corrugated with Z-Shaped Locking Seam: 0.016 inch thick.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum, Deep Corrugations 2-1/2-Inch-Box Ribs: 0.040 inch thick.
2. Stainless Steel, Type 304 or 316, Deep Corrugations 2-1/2-Inch-Box Ribs: 0.020 inch thick.

F. Piping, Concealed:
1. PVC: 20 mils thick.
2. Aluminum, Stucco Embossed: 0.016 inch thick.

G. Piping, Exposed:

1. PVC: 20 mils thick.
2. Aluminum, Stucco Embossed with Z-Shaped Locking Seam: 0.016 inch thick.

END OF SECTION

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SECTION 22 1116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes domestic water piping from 5’ outside of building to fixtures and equipment inside the building.

B. Water meters will be furnished and installed by utility company.

C. Related Sections include the following:

1. Division 22 Section "Thermometers and Gages for Plumbing Piping" for thermometers, pressure gages, and fittings.
2. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 160 psig for domestic water service piping and 125 psig for domestic water distribution piping.

1.3 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Samples: Specified in Part 3 "Cleaning" Article. Samples are submitted to Health Authorities having jurisdiction.

C. Field quality-control test reports. Indicate and interpret test results for compliance with performance requirements.

D. Shop drawings of potable water system for review by Engineer before construction begins.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

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 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

C. Transition couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body, with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
4. Cast-Iron Flanges: ASME B16.1, Class 125.
5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
6. Steel-Piping, Grooved-End Fittings: ASTM A 47/A 47M, galvanized**,** malleable-iron casting; ASTM A 106, galvanized steel pipe; or ASTM A 536, galvanized**,** ductile-iron casting; with dimensions matching steel pipe.

a. Steel-Piping, Grooved-End-Pipe Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

7. Steel-Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
8. Steel-Piping, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

2.4 DUCTILE-IRON PIPING

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell and plain-spigot end, unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile or gray iron glands, rubber gaskets and steel bolts.

2. Ductile-Iron Piping, Grooved-End Fittings: ASTM A47, malleable iron castings or ASTM A536 ductile-iron castings with dimensions matching pipe.

a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile iron pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

B. Push on joint, ductile iron pipe: AWWA C151, with push on joint, bell and plain spigot end, unless grooved or flanged ends are indicated.

1. Push on joint, Ductile iron Fittings: AWWA C110, ductile or gray iron standard pattern; or AWWA C153, ductile iron, compact pattern.

a. Gaskets: AWWA C111, rubber.

2. Ductile-Iron Piping, Grooved-End Fittings: ASTM A47, malleable iron castings or ASTM A536 ductile-iron castings with dimensions matching pipe.

a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile iron pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.5 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Types K, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. 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. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. 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.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

a. Copper-tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water and bolts and nuts.

2.6 PE ENCASEMENT

A. PE Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105 PE film, 0.008-inch minimum thickness, tube or sheet.

2.7 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

E. Underground Domestic Water Piping: Use any of the following piping materials for each size range:
1. NPS 2-1/2 and smaller: Soft copper tube, Type K; copper pressure fittings; and brazed joints.

F. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
1. All pipe sizes: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

G. Non-Potable-Water Piping: Same as for potable water piping.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements shall apply:
1. Shut-off duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball valves for piping NPS 2 and smaller. Use cast-iron butterfly valve with flanged ends for piping NPS 2-1/2 and larger.
3. Hot water piping, balancing duty: Calibrated balancing valves.
4. Drain duty: Hose-end drain valves.

B. Cast-iron, grooved-end valves may be used with grooved-end piping.

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install underground PE piping according to ASTM D 2774 and ASTM F 645.

D. Install underground PVC piping according to ASTM D 2774 and ASTM F 645.

E. 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. Refer to Division 22 Section "Common Work Results for Plumbing" for sleeves and mechanical sleeve seals.

F. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

G. Install underground ductile-iron piping according to AWWA C600 and NFPA 24. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets. Encase piping with polyethylene film according to ASTM A 674 or AWWA C105.

H. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 22 Section "Thermometers and Gages for Plumbing Piping," and drain valves and strainers are specified in Division 22 Section "Domestic Water Piping Specialties."

I. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 22 Section " Domestic Water Piping Specialties."

J. Install domestic water piping level without pitch and plumb. Retain paragraph below if water meters are inside the building.

K. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

L. Perform the following steps before operation:

- Close drain valves, hydrants, and hose bibbs.
- Open shutoff valves to fully open position.
- Open throttling valves to proper setting.
- Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
- Remove and clean strainer screens. Close drain valves and replace drain plugs.
- Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

M. Check all plumbing-specialties and verify proper settings, adjustments and operation.

N. Energize pumps and verify proper operation.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. 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.

C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.6 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping NPS 3 and smaller.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball valves for piping NPS 3 and smaller. Use butterfly ro gate valves for piping NPS 4 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.

1. Install hose-end drain valves at low points in water mains, risers and branches.

2. Install stop and waste drain valves where indicated or when required by manufacturers.

D. Install calibrated balancing valves in each hot water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

3.7 WATER METER INSTALLATION

A. Rough-in domestic water piping according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

C. Install water meters according to AWWA M6 and utility's requirements.

1. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
2. Install turbine-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
3. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.
4. Install fire-service water meters with shutoff valves on water-meter inlet and outlet and on full-size valved bypass around meter. Support meter, valves, and piping on brick or concrete piers.
5. Install remote registration system according to standards of utility and of authorities having jurisdiction.

3.8 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices 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: MSS Type 49, spring cushion rolls, if indicated.

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.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 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 and NPS 3-1/2: 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.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

F. Install supports for vertical steel piping every 15 feet.

G. 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.
7. NPS 8: 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

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, and extend and connect to the following:

1. Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water supply 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. Refer to plans.
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 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

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 24 hours 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 test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

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 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 required corrective action.

3.11 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

B. Adjust balancing valves in hot-water circulation return piping to provide adequate flow:

1. Manually adjust ball-type balancing valves in hot-water circulation return piping to provide flow of hot water in each branch.

2. Adjust calibrated balancing valves to flows indicated.

CLEANING

C. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as 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.

D. Prepare and submit reports of purging and disinfecting activities.

E. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 1119

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. Temperature-actuated water mixing valves.
4. Strainers.
5. Outlet boxes.
6. Hose stations.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water hammer arresters.
11. Air vents.

B. Related Sections include the following:

1. Division 22 Section "Thermometers and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.

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. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

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. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. 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. Ames Co.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. FEBCO; SPX Valves & Controls.
e. Rain Bird Corporation.
f. Toro Company (The); Irrigation Div.
g. Watts Industries, Inc.; Water Products Div.
h. 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 for outdoor or service areas (like a hose bib), chrome plated for finished areas (like a toilet room).

B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arrowhead Brass Products, Inc.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. Legend Valve.
e. MIFAB, Inc.
f. Prier Products, Inc.
g. Watts Industries, Inc.; Water Products Div.
h. Woodford Manufacturing Company.
i. Zurn Plumbing Products Group; Light Commercial Operation.
j. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze for outdoor or service areas (like a hose bib), chrome plated for finished areas (like a toilet room or mop sink).

C. Pressure Vacuum Breakers :
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. Flomatic Corporation.
e. Toro Company (The); Irrigation Div.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size: same as fixture supply size
6. Design Flow Rate: same as fixture
7. Selected Unit Flow Range Limits: As per drawings
8. Accessories:

    a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Size: Same as supply connection.
5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

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. Flomatic Corporation.
    e. Watts Industries, Inc.; Water Products Div.
    f. 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 required to limit pressure loss.
6. Design Flow Rate: See schedule.
7. Selected Unit Flow Range Limits: Gpm corresponding to maximum pressure loss allowed.
8. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
9. End Connections: Threaded for NPS 2 and smaller; flanged or grooved for NPS 2-1/2 and larger.
10. Configuration: See plans.
11. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 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. Flomatic Corporation.
    e. Watts Industries, Inc.; Water Products Div.

f. 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 required to limit pressure loss.
6. Design Flow Rate: See schedule.
7. Selected Unit Flow Range Limits: Gpm corresponding to maximum pressure loss allowed.
8. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
9. End Connections: Threaded for NPS 2 and smaller; flanged or grooved for NPS 2-1/2 and larger.
10. Configuration: See plans.
11. 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. Hose-Connection Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Watts Industries, Inc.; Water Products Div.
c. Woodford Manufacturing Company.

2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

2.3 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. Cash Acme.
c. Conbraco Industries, Inc.
d. Honeywell Water Controls.
e. Legend Valve.
f. Leonard Valve Company.
g. Powers; a Watts Industries Co.
h. Symmons Industries, Inc.
i. Taco, Inc.
j. Watts Industries, Inc.; Water Products Div.
k. 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: 110 deg F
9. Tempered-Water Design Flow Rate: See schedule
10. Valve Finish: 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. Powers; a Watts Industries Co.
    e. Symmons Industries, Inc.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: 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: 110 deg F
10. Tempered-Water Design Flow Rate: See schedule.
11. Pressure Drop at Design Flow Rate: 5 psig
12. Valve Finish: Rough bronze.
13. Piping Finish: Copper.
14. Cabinet: Factory-fabricated, stainless steel, for surface mounting and with hinged, stainless-steel lockable door.

C. Individual-Fixture, Water Tempering Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. Honeywell Water Controls.
    d. Lawler Manufacturing Company, Inc.
    e. Leonard Valve Company.
    f. Powers; a Watts Industries Co.
    g. Watts Industries, Inc.; Water Products Div.
    h. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F
9. Tempered-Water Design Flow Rate: 0.5 gpm.

2.4 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 or grooved 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 6 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.5 OUTLET BOXES

A. Clothes Washer Outlet Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company.
b. Guy Gray Manufacturing Co., Inc.
c. IPS Corporation.
d. LSP Products Group, Inc.
e. Oatey.
f. Plastic Oddities; a division of Diverse Corporate Technologies.
g. Symmons Industries, Inc.
h. Watts Industries, Inc.; Water Products Div.
i. Zurn Plumbing Products Group; Light Commercial Operation.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
4. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets. Faucets shall include water hammer arrestors.
5. Supply Shutoff Fittings: NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
6. Drain: NPS 1-1/2 or NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Outlet Hoses: Two 60-inch-long, stainless steel household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company.
b. IPS Corporation.
c. LSP Products Group, Inc.
d. Oatey.
e. Plastic Oddities; a division of Diverse Corporate Technologies.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.6 HOSE STATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARCHON Industries, Inc.
2. Armstrong International, Inc.
3. Cooney Brothers, Inc.
4. DynaFluid Ltd.
5. Leonard Valve Company.
6. Strahman Valves, Inc.
7. T & S Brass and Bronze Works, Inc.

B. Single-Temperature-Water Hose Stations:

1. Standard: ASME A112.18.1.
2. Cabinet: Stainless-steel enclosure with exposed valve handle, hose connection, and hose rack. Include thermometer in front.
3. Hose-Rack Material: Stainless steel.
4. Body Material: Bronze with stainless-steel wetted parts.
5. Body Finish: Rough bronze for service area, chrome plated for finish area.
6. Mounting: Wall, with reinforcement or, Floor, with stainless-steel pedestal. See schedule
7. Supply Fitting: NPS 3/4 gate, globe, or ball valve and check valve and NPS 3/4 copper, water tubing. Omit check valve if check stop is included with fitting.
8. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; See schedule for length.
9. Nozzle: With hand squeeze on-off control.
10. Vacuum Breaker: Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7 on outlet.

2.7 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company.
b. Prier Products, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Woodford Manufacturing Company.
g. Zurn Plumbing Products Group; Light Commercial Operation.
h. Zurn Plumbing Products Group; Specification Drainage 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: Chrome plated.
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.

2.8 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.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.9 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.

2.10 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 or NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.

4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

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

D. 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.

E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

F. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

G. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install shutoff valve on outlet if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

H. Install ground hydrants with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.

I. Install draining-type post hydrants with 1 cu. yd. (0.75 cu. m) of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

J. Install nonfreeze, nondraining-type post hydrants set in concrete or pavement.

K. Install freeze-resistant yard hydrants with riser pipe set in concrete or pavement. Do not encase canister in concrete.

L. Install water hammer arresters in water piping according to PDI-WH 201.

M. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

N. 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.

O. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

P. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

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 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check backflow-prevention assemblies.
5. Carbonated-beverage-machine backflow preventers.
6. Dual-check-valve backflow preventers.
7. Reduced-pressure-detector, fire-protection backflow-preventer assemblies.
8. Double-check, detector-assembly backflow preventers.
9. Water pressure-reducing valves.
10. Calibrated balancing valves.
11. Primary, thermostatic, water mixing valves.
12. Manifold, thermostatic, water-mixing-valve assemblies.
13. Photographic-process, thermostatic, water-mixing-valve assemblies.
14. Primary water tempering valves.
15. Outlet boxes.
16. Hose stations.
17. Supply-type, trap-seal primer valves.
18. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly, and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

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SECTION 22 1125

FACILITY NATURAL 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.
6. Service meters.
7. Mechanical sleeve seals.
8. Grout.
9. Concrete bases.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 65 psig.

B. Natural-Gas System Pressure within Buildings: 0.5 psig.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.

2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars and supports.
6. Dielectric fittings.
7. Mechanical sleeve seals.
8. Escutcheons.

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.

C. 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.

D. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

E. Qualification Data: For qualified professional engineer.

F. Welding certificates.

G. Field quality-control reports.

H. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.7 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect, Construction Manager, or Owner no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Architect's, Construction Manager's, or Owner's written permission.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

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. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

a. Material Group: 1.1.
b. End Connections: Threaded or butt welding to match pipe.
c. Lapped Face: Not permitted underground.
d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.
3) Victaulic.

b. Steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Steel bolts, washers, and nuts.
e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. OmegaFlex, Inc.
b. Parker Hannifin Corporation; Parflex Division.
c. Titeflex.
d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.

C. Aluminum Tubing: Comply with ASTM B 210 and ASTM B 241/B 241M.

1. Aluminum Alloy: Alloy 5456 is prohibited.
2. Protective Coating: Factory-applied coating capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.
3. Flare Fittings: Comply with ASME B16.26 and SAE J513.

a. Copper-alloy fittings.
b. Metal-to-metal compression seal without gasket.
c. Dryseal threads shall comply with ASME B1.20.3.

D. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K or ASTM B 837, Type G.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

E. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K or ASTM B 837, Type G.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Flare Fittings: Comply with ASME B16.26 and SAE J513.

    a. Copper fittings with long nuts.
    b. Metal-to-metal compression seal without gasket.
    c. Dryseal threads complying with ASME B1.20.3.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

F. Tin-Lined Copper Tube: ASTM B 280, seamless, annealed, with interior tin-plated lining.

1. Flare Fittings: Comply with ASME B16.26 and SAE J513.

    a. Copper fittings with long nuts.
    b. Metal-to-metal compression seal without gasket.
    c. Dryseal threads complying with ASME B1.20.3.

G. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    c. Aboveground Portion: PE transition fitting.
    d. Outlet shall be threaded or flanged or suitable for welded connection.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    b. Outlet shall be threaded or flanged or suitable for welded connection.
    c. Bridging sleeve over mechanical coupling.
    d. Factory-connected anode.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings,NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Lyall, R. W. & Company, Inc.
2) Mueller Co.; Gas Products Div.
3) Perfection Corporation; a subsidiary of American Meter Company.

b. PE body with molded-in, stainless-steel support ring.
c. Buna-nitrile seals.
d. Acetal collets.
e. Electro-zinc-plated steel stiffener.

6. Plastic Mechanical Couplings,NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Lyall, R. W. & Company, Inc.
2) Mueller Co.; Gas Products Div.
3) Perfection Corporation; a subsidiary of American Meter Company.

b. Fiber-reinforced plastic body.
c. PE body tube.
d. Buna-nitrile seals.
e. Acetal collets.
f. Stainless-steel bolts, nuts, and washers.

7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.

b. Steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Steel bolts, washers, and nuts.
e. Factory-installed anode for steel-body couplings installed underground.

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. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches.

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.

4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, 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: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 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 (540 deg C) 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. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.

6. Service Mark: Valves 1-1/4 inches to NPS 2) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
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 shall 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, provide products by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Lyall, R. W. & Company, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
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 shall 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. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McDonald, A. Y. Mfg. Co.
b. Mueller Co.; Gas Products Div.
c. Xomox Corporation; a Crane company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall 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. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Kerotest Manufacturing Corp.
b. Lyall, R. W. & Company, Inc.
c. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: 0 to plus 140 deg F.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

H. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 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. 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.

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: 0.5 psig.

2.6 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
f. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
d. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 SLEEVES: See section, “Common Works”

2.8 MECHANICAL SLEEVE SEALS: See section, “Common Works”

2.9 ESCUTCHEONS: See section, “Common Works”

2.10 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.11 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code 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 Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM 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. Aboveground, Exterior-Wall Pipe Penetrations: Gas piping entering the building is preferred to be above grade with a self-tightening swing joint prior to entering the building and must be protected from accidental damage by vehicles, foundation settling, or vibration. Seal penetrations using 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

H. Underground, Exterior-Wall Pipe Penetrations: Contractor shall attain written approval from owner prior to installing gas piping in this application. Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

I. 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.

J. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Thermometers and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and

other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install escutcheons at penetrations of interior walls, ceilings, and floors. See section, “Common Works”.

L. 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."

M. Verify final equipment locations for roughing-in.

N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

O. 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.

P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

Q. 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.

R. Concealed Location Installations: Only above an accessible ceiling.

S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

T. Connect branch piping from top or side of horizontal piping.

U. 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.

V. Do not use natural-gas piping as grounding electrode.

W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

X. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

Y. Gas should not be piped through confined spaces such as trenches or unventilated shafts.

Z. Diaphragms in gas piping must be vented to the outside.

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 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.
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

B. Install hangers for horizontal drawn-temper copper 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 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.

C. 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.

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC 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.

3.10 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel gloss.
d. Color: Yellow.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex gloss.
d. Color: Yellow.

2. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd gloss.
d. Color: Yellow.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
1. Install anchor bolts to elevations required for proper attachment to supported equipment.

E. Perform tests and inspections.

F. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

G. Natural-gas piping will be considered defective if it does not pass tests and inspections.

H. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, exterior branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
3. Annealed-temper, copper tube with wrought-copper fittings and brazed or flared joints.
4. Aluminum tube with flared fittings and joints.
5. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, exterior distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Aboveground, interior piping shall be one of the following:

1. Standard weight, Schedule 40 black steel pipe.
   a. Malleable iron fittings conforming to ASTM A-53.
2. Corrugated steel piping sleeved with schedule 40 PVC may be used in concealed locations such as walls or casework.

D. Underground, below building, piping shall be one of the following:

1. Polyethylene gas pressure pipe.
   a. Fittings with fused joints.

E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.13 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, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve.

E. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION

SECTION 22 1316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

B. Related Sections include the following:

1. Division 22 Section "Sanitary Sewerage Pumps."
2. Division 22 Section "Sanitary Waste Piping Specialties".

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.3 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.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:
1. Sanitary waste and vent System: Include plans, elevations and sections (as required), and details. Provide shop drawings for review before construction.

C. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

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 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PVC PIPE AND FITTINGS:

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Piping: Schedule 40

2. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.4 CPVC PIPE AND FITTINGS:

A. Solid-Wall CPVC Pipe: ASTM F 2618 special drainage system for corrosive, chemical, or acid waste. Flame retardant in accordance with ASTM F-1412.

1. CPVC Piping: Schedule 40.

2. CPVC Socket Fittings: ASTM F493, socket type, made to ASTM D 3311, drain, waste, and vent patterns. Mechanical joints may be used above slab. Fusion joints are required below slab.

2.5 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.6 COPPER TUBE AND FITTINGS

A. 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.

B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

C. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.7 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:

a. Dallas Specialty & Mfg. Co.
b. Fernco, Inc.
c. Logan Clay Products Company (The).
d. Mission Rubber Co.
e. NDS, Inc.
f. Plastic Oddities, Inc.

2. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Mission Rubber Co.

C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:

a. ANACO.

D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser, Inc.; DMD Div.
c. EBAA Iron Sales, Inc.
d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
e. JCM Industries, Inc.
f. Romac Industries, Inc.
g. Smith-Blair, Inc.
h. Viking Johnson.

2. Center-Sleeve Material: Manufacturer's standard.
3. Gasket Material: Natural or synthetic rubber.
4. Metal Component Finish: Corrosion-resistant coating or material.

E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.

1. Available Manufacturers:

a. EBAA Iron Sales, Inc.

F. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Available Manufacturers:

a. SIGMA Corp.
b. GPD (Link Seal).

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Hub-and-spigot, cast-iron soil pipe and fittings shall be used in all soil, waste and vent piping (both aboveground and belowground) applications with the following exceptions:
1. Renovations of existing systems: New piping installed in partial replacement of existing systems shall match the material of the previously existing piping to maintain consistency of material throughout the facility. New piping shall be installed in accordance with the standards described in this section.
2. Kitchens: All exposed piping in kitchens or food prep areas shall be DWV copper.
3. Science Classrooms and Acid Waste: Acid waste piping shall be chemical resistant, schedule 40 CPVC and flame retardant according to ASTM F-1412.

B. Condensate drain piping shall comply with the following material and installation guidelines:

1. All condensate within the building interior shall be type DWV copper.
2. Condensate piping on the building exterior shall be schedule 40 CPVC and painted with UV resistant paint.
3. Condensate piping in building shall be insulated with close-cell flexible elastomeric insulation.
4. Condensate piping shall terminate in accessible location.
5. Condensate piping connections to equipment shall have a trap as recommended by equipment manufacturer.

C. Note Regarding Return Air Plenums: Plastic piping (PVC or CPVC) is not an allowable material in return air plenums.

D. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

E. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install underground, ductile-iron, special pipe fittings according to AWWA C600.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

F. 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."

G. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

H. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

I. 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.

J. 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.

K. 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.

L. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

M. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

N. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

O. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

P. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. 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.

F. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 and smaller.
2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialities."

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. Install 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. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

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.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical steel piping every 15 feet (4.5 m).

J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS: 84 inches with 3/8-inch rod.
2. NPS 3: 96 inches with 1/2-inch rod.
3. NPS 4: 108 inches with 1/2-inch rod.
4. NPS 6: 10 feet with 5/8-inch rod.

K. Install supports for vertical stainless-steel piping every 10 feet (3 m).

L. 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.
6. NPS 8: 10 feet with 3/4-inch rod.

M. Install supports for vertical copper tubing every 10 feet (3 m).

N. Install hangers for ABS and or PVC 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.
3. NPS 4 and 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.

O. Install supports for vertical ABS and or PVC piping every 48 inches.

P. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
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 (DN 65) 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 or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. 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.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. 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.

3.10 SMOKE TESTING

A. All sanitary sewer systems (both sanitary waste and vent piping) shall be smoke tested by an independent contractor hired by the General Contractor.

3.11 PROTECTION

A. Exposed PVC or Plastic Piping: Protect plumbing vents and condensate drain piping exposed to sunlight with two coats of water-based latex UV-resistant paint.

END OF SECTION

SECTION 22 1319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Air-admittance valves.
5. Roof flashing assemblies.
6. Through-penetration firestop assemblies.
7. Miscellaneous sanitary drainage piping specialties.
8. Flashing materials.

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, roof drains, and catch basins.
2. Division 22 Section "Plumbing Fixtures" for hair interceptors.

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. All items listed in 1.2, A. of this specification

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

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 NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Josam Company; Josam Div.

b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

C. Horizontal, Plastic Backwater Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Canplas LLC.
b. IPS Corporation.
c. NDS Inc.
d. Oatey.
e. Plastic Oddities; a division of Diverse Corporate Technologies.
f. Sioux Chief Manufacturing Company, Inc.
g. Zurn Plumbing Products Group; Light Commercial Operation.

2. Size: Same as connected piping.
3. Body: ABS or PVC.
4. Cover: Same material as body with threaded access to check valve.
5. Check Valve: Removable swing check.
6. End Connections: Socket type.

2.2 CLEANOUTS

A. Exposed Metal 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. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.
f. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: as required to match connected piping.
5. Closure: Countersunk plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. Oatey.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group; Light Commercial Operation.
h. Zurn Plumbing Products Group; Specification Drainage Operation.
i. Josam Company; Josam Div.

j. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Threaded.
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.
11. Frame and Cover Shape: Square.
12. Top Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting 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. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: as required to match connected piping.
5. Closure: Countersunk 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.

2.3 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. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Light Commercial Operation.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3

3. Features: See Schedule.

B. Stainless-Steel Floor Drains :
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Blucher-Josam Div.
b. Josam Company; Josam Div.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.

e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.3.1

3. Features: See Schedule..

2.4 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ayrlett, LLC.
b. Durgo, Inc.
c. Oatey.
d. ProSet Systems Inc.
e. RectorSeal.
f. Studor, Inc.

2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Durgo, Inc.
b. Oatey.
c. Studor, Inc.

2. Standard: ASSE 1050 for vent stacks.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected stack vent or vent stack.

C. Wall Box:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Durgo, Inc.
b. Oatey.
c. RectorSeal.
d. Studor, Inc.

2. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
3. Size: About 9 inches wide by 8 inches high by 4 inches deep.

2.5 ROOF FLASHING ASSEMBLIES: See Architectural drawings and specifications.

2.6 THROUGH-PENETRATION FIRESTOP ASSEMBLIES: See Architectural drawings and specifications.

2.7 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch-minimum water seal.
b. NPS 2-1/2and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. 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.

E. 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 2 inches 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.

F. 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.

G. 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.

H. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.8 FLASHING MATERIALS: See Architectural drawings and specifications.

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 backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. 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.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. 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.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

H. Install fixture air-admittance valves on fixture drain piping.

I. Install stack air-admittance valves at top of stack vent and vent stack piping.

J. Install air-admittance-valve wall boxes recessed in wall.

K. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

L. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

M. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

N. Assemble open drain fittings and install with top of hub 2 inches above floor.

O. Install deep-seal traps on floor drains and other waste outlets, if indicated.

P. 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.

Q. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

R. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

S. Install vent caps on each vent pipe passing through roof.

T. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

U. Install wood-blocking reinforcement for wall-mounting-type specialties.

V. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

W. 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.

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 FLASHING INSTALLATION (Coordinate with Architectural drawings and specifications)

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.
2. Copper Sheets: Solder joints of copper sheets.

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.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Backwater valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 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.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 22 3400

FUEL FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following fuel-fired water heaters:
   1. Commercial, direct-vent, storage, gas water heaters.
   2. Compression tanks.
   3. Water heater accessories.

1.2 DEFINITIONS

A. LP Gas: Liquefied-petroleum fuel gas.

1.3 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. Product Certificates: For each type of commercial and instantaneous water heater, signed by product manufacturer.

D. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      a. 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."

   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Source quality-control test reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance:

1. 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 01.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

E. 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.

1.5 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired 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 Owner Acceptance: All components – five (5) years each. Coordinate with Owner.

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 COMMERCIAL, GAS WATER HEATERS

A. Available Manufacturers:
1. Lochinvar Corporation.

2. Raypak

B. Commercial, Direct Vent, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
1. Available Manufacturers:
a. Lochinvar Corporation.
b. Raypak.

2. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends 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. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Lining: Glass or Sheet copper complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

3. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner: For use with direct-vent water heaters and for natural-gas fuel.
g. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
h. Temperature Control: Adjustable thermostat.
i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
j. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.
5. Draft Hood: Draft diverter; complying with ANSI Z21.12.
6. Automatic Damper: ANSI Z21.thermally activated, automatic-vent-damper device with size matching draft hood.
7. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.
8. Capacity and Characteristics: See schedule.

2.3 COMPRESSION TANKS

A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

1. Available Manufacturers:

a. AMTROL Inc.
b. Armstrong Pumps, Inc.
c. Flexcon Industries.
d. Honeywell Sparco.

e. Myers, F. E.; Pentair Pump Group (The).
f. Smith, A. O.; Aqua-Air Div.
g. State Industries, Inc.
h. Taco, Inc.
i. Watts Regulator Co.
j. Wessels Co.

2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: See schedule.
c. Air Precharge Pressure: System pressure + 10 psig,

2.4 WATER HEATER ACCESSORIES

A. Circulator Pumps: Each hot water system shall be provided with a pumped circulating return. Systems shall meet the following criteria:
1. Pump Control: Each pump shall be provided with H-O-A switch and aquastat. The aquastat shall be connected through the automatic side of the H-O-A switch and in series with the district EMS. The automatic circuit shall be extended to numbered terminal strips at the HVAC/Security/EMS interface panel.
2. Valves and Trim: Line size ball valves with unions (in addition to any bolted flange connections) shall be provided on each side of pump. Pressure taps, and thermometer wells are not required on in-line circulators. Use cartridge type in- line circulators. Taco 008-0012.
3. Provide thermostatic mixing vales on all remodels.
4. Provide Hi–Low thermostatic mixing valves with on all new schools or new additions. Leonard TM-1520A-LF-RF.

B. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.

C. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.

D. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.

E. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.

1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

F. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch-high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.

G. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Provide dimension that will support bottom of water heater a minimum of 18 inches above the floor.

H. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.

I. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

J. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

K. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

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 seismic restraints for commercial water heaters. Anchor to substrate.

D. Install gas water heaters according to NFPA 54.

E. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.

F. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.

G. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.

H. Install oil-fired water heaters according to NFPA 31.

I. 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.

J. Install combination temperature and pressure relief valves in water piping for water heaters without storage. 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.

K. 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.

L. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

M. Install pressure gage(s) on inlet and outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

N. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

O. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

P. Fill water heaters with water.

Q. Charge compression tanks with air.

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 water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

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. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

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 instantaneous and commercial water heaters. Refer to Division 01 Section "Demonstration and Training."

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SECTION 22 4000

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories, showers, and sinks.
2. Laminar-flow faucet-spout outlets.
3. Flushometers.
4. Toilet seats.
5. Protective shielding guards.
6. Fixture supports.
7. Interceptors.
8. Water closets.
9. Urinals.
10. Lavatories.
11. Pressure Water Coolers.
12. Owner-furnished fixtures.

B. Related Sections include the following (as applicable):

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 22 Section "Domestic Water Filtration Equipment" for water filters.
4. Division 22 Section "Healthcare Plumbing Fixtures."
5. Division 22 Section "Emergency Plumbing Fixtures."
6. Division 22 Section "Security Plumbing Fixtures."
7. 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.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. 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 plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

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. 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 plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Plastic Bathtubs: ANSI Z124.1.
3. Plastic Lavatories: ANSI Z124.3.
4. Plastic Laundry Trays: ANSI Z124.6.
5. Plastic Mop-Service Basins: ANSI Z124.6.
6. Plastic Shower Enclosures: ANSI Z124.2.
7. Plastic Sinks: ANSI Z124.6.
8. Plastic Urinal Fixtures: ANSI Z124.9.
9. Plastic Whirlpool Bathtubs: ANSI Z124.1 and ASME A112.19.7M.
10. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
11. Slip-Resistant Bathing Surfaces: ASTM F 462.
12. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
13. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.

14. Stainless-Steel Residential Sinks: ASME A112.19.3.
15. Vitreous-China Fixtures: ASME A112.19.2M.
16. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
17. Water-Closet, Flushometer Tank Trim: ASSE 1037.
18. Whirlpool Bathtub Fittings: ASME A112.19.8M.

H. 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.

I. Comply with the following applicable standards and other requirements specified for bathtub/shower and shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
4. Faucets: ASME A112.18.1.
5. Hand-Held Showers: ASSE 1014.
6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Manual-Control Antiscald Faucets: ASTM F 444.
9. Pipe Threads: ASME B1.20.1.
10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

J. 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. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F 409.
6. Brass Waste Fittings: ASME A112.18.2.
7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Dishwasher Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Floor Drains: ASME A112.6.3.
5. Grab Bars: ASTM F 446.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Hot-Water Dispensers: ASSE 1023 and UL 499.
8. Off-Floor Fixture Supports: ASME A112.6.1M.
9. Pipe Threads: ASME B1.20.1.

10. Plastic Shower Receptors: ANSI Z124.2.
11. Plastic Toilet Seats: ANSI Z124.5.
12. Supply and Drain Protective Shielding Guards: ICC A117.1.
13. Whirlpool Bathtub Equipment: UL 1795.

1.5 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period. Warranty periods shall be coordinated with the Owner. All warranties date from the date of Owner Acceptance.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 1 of each type.
4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Flushometer Tank, Repair Kits: Equal to 5 percent of amount of each type installed, but no fewer than 2 of each type.
6. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
7. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard Companies, Inc.
b. Bradley Corporation.
c. Chicago Faucets.
d. Delta Faucet Company.
e. Eljer.
f. Elkay Manufacturing Co.
g. Fisher Manufacturing Co.
h. Grohe America, Inc.
i. Just Manufacturing Company.
j. Kohler Co.
k. Moen, Inc.
l. Royal Brass Mfg. Co.
m. Speakman Company.
n. T & S Brass and Bronze Works, Inc.

o. Zurn Plumbing Products Group; Commercial Brass Operation.
p. Brasstech Inc.; Newport Brass Div.
q. Central Brass Manufacturing Company.
r. hicago Faucets.
s. Franke Consumer Products, Inc.; Kitchen Systems Div.
t. Gerber Plumbing Fixtures LLC.

2. Description: See schedule

2.2 SHOWER FAUCETS

A. Shower Faucets:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard Companies, Inc.
b. Brasstech Inc.; Newport Brass Div.
c. Broadway Collection.
d. Central Brass Manufacturing Company.
e. Chicago Faucets.
f. Delta Faucet Company.
g. Eljer.
h. Gerber Plumbing Fixtures LLC.
i. Hansgrohe Inc.
j. Kohler Co.
k. Leonard Valve Company.
l. Moen, Inc.
m. Paul Decorative Products.
n. Pegler, Ltd.
o. Powers; a Watts Industries Co.
p. Price Pfister, Inc.
q. Rohl LLC.
r. Royal Brass Mfg. Co.
s. Sayco; a Briggs Plumbing Products, Inc. Company.
t. Speakman Company.
u. Sterling Plumbing Group, Inc.
v. St. Thomas Creations.
w. Symmons Industries, Inc.
x. T & S Brass and Bronze Works, Inc.
y. Wolverine Brass, Inc.
z. Zurn Plumbing Products Group; AquaSpec Commercial Faucet Operation.

2. Description: See schedule.

2.3 SINK FAUCETS

A. Sink Faucets:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard Companies, Inc.
b. Bradley Corporation.
c. Broadway Collection.
d. Chicago Faucets.
e. Delta Faucet Company.
f. Dormont Manufacturing Company.
g. Eljer.
h. Elkay Manufacturing Co.
i. Fisher Manufacturing Co.

j. Grohe America, Inc.
k. Just Manufacturing Company.
l. Kohler Co.
m. Moen, Inc.
n. Royal Brass Mfg. Co.
o. Sayco; a Briggs Plumbing Products, Inc. Company.
p. Speakman Company.
q. T & S Brass and Bronze Works, Inc.
r. Zurn Plumbing Products Group; Commercial Brass Operation.
s. American Standard Companies, Inc.
t. Bradley Corporation.
u. Brasstech Inc.; Newport Brass Div.
v. Broadway Collection.
w. Central Brass Manufacturing Company.
x. Chicago Faucets.
y. Delta Faucet Company.
z. Eljer.

2. Description: See schedule

2.4 LAMINAR-FLOW FAUCET-SPOUT OUTLETS

A. Laminar-Flow Faucet-Spout Outlets:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Chronomite Laboratories, Inc.
b. NEOPERL, Inc.

2. Description: Chrome-plated-brass faucet-spout outlet that produces non-aerating, laminar stream. Include male or female thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.5 FLUSHOMETERS

A. Flushometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Coyne & Delany Co.
b. Delta Faucet Company.
c. Sloan Valve Company.
d. Zurn Plumbing Products Group; Commercial Brass Operation.
e. Hydrotek International, Inc.
f. Sloan Valve Company.
g. TOTO USA, Inc.
h. Coyne & Delany Co.
i. Delta Faucet Company.
j. Hydrotek International, Inc.
k. Sloan Valve Company.
l. TOTO USA, Inc.
m. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: See schedule.

2.6 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard Companies, Inc.
    b. Bemis Manufacturing Company.
    c. Centoco Manufacturing Corp.
    d. Church Seats.
    e. Eljer.
    f. Kohler Co.
    g. Olsonite Corp.
    h. Sanderson Plumbing Products, Inc.; Beneke Div.
    i. Sperzel.
    j. Bemis Manufacturing Company.
    k. Centoco Manufacturing Corp.
    l. Church Seats.
    m. Kohler Co.
    n. Olsonite Corp.

2. Description: Toilet seat for water-closet-type fixture. See schedule.

2.7 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Engineered Brass Co.
    b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
    c. McGuire Manufacturing Co., Inc.
    d. Plumberex Specialty Products Inc.
    e. TCI Products.
    f. TRUEBRO, Inc.
    g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. TRUEBRO, Inc.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.8 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 and 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 or II, urinal carrier with hanger and bearing plates 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 \I, lavatory carrier with exposed arms and tie rods or II, lavatory carrier with concealed arms and tie rod or III, lavatory carrier with hanger plate 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 I, sink carrier with exposed arms and tie rods or II, sink carrier with hanger plate, bearing studs, and tie rod or III, sink carrier with hanger plate and exposed arms for sink-type fixture. Include steel uprights with feet.

F. Water Cooler Supports

1. 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.
   a. Type I: Hanger-type carrier with two vertical uprights.
   b. Type II: Bilevel, hanger-type carrier with three vertical uprights.
   c. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

2.9 INTERCEPTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
5. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Hair Interceptors:

1. Description: Manufactured unit with removable screen or strainer and removable cover; designed to trap and retain hair.

   a. Material: Brass or stainless-steel body.
   b. Pipe Connections: NPS 1-1/2.

2.10 WATER CLOSETS

A. Water Closets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Plumbing, L.L.C./Fiat Products.
    b. American Standard Companies, Inc.
    c. Briggs Plumbing Products, Inc.
    d. Capizzi.
    e. Crane Plumbing, L.L.C./Fiat Products.
    f. Eljer.
    g. Kohler Co.
    h. St. Thomas Creations.
    i. TOTO USA, Inc.
    j. Eljer.
    k. Kohler Co.

2. Description See schedule.

2.11 URINALS

A. Urinals:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard Companies, Inc.
    b. Briggs Plumbing Products, Inc.
    c. Capizzi.
    d. Crane Plumbing, L.L.C./Fiat Products.
    e. Duravit USA, Inc.
    f. Eljer.
    g. Kohler Co.
    h. Mansfield Plumbing Products, Inc.
    i. Peerless Pottery, Inc.
    j. Sanitarios Azteca, S.A. de C.V.
    k. St. Thomas Creations.
    l. TOTO USA, Inc.

2. Description: See schedule.

2.12 LAVATORIES

A. Lavatories:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard Companies, Inc.
    b. Commercial Enameling Company.
    c. Eljer.
    d. Kohler Co.
    e. American Standard Companies, Inc.
    f. Barclay Products, Ltd.
    g. Briggs Plumbing Products, Inc.
    h. Crane Plumbing, L.L.C./Fiat Products.
    i. Eljer.
    j. Gerber Plumbing Fixtures LLC.
    k. Kohler Co.
    l. Mansfield Plumbing Products, Inc.
    m. Peerless Pottery, Inc.
    n. Sterling Plumbing Group, Inc.
    o. St. Thomas Creations.
    p. TOTO USA, Inc.

2. Description: See schedule.

2.13 PRESSURE WATER COOLERS

A. Water Coolers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Halsey Taylor.

2. Description: See plumbing schedule.
a. Provide all stainless steel finish, unless designated otherwise by Architect.
b. Furnish accessory apron when units are mounted on an exposed wall or necessary to provide the ADA mandatory underside clearance.
c. Provide owner with 12 pack filter replacement, Halsey Taylor – 55898C-12PK or approved equal.
d. Provide McGuire chrome riser supply with wheel handle stop and chrome escutcheon plate with set screw.
e. P-Trap: McGuire 1-1/4” x 1-1/2”, 17 gauge, chrome cast brass P-trap with cleanout plug and chrome escutcheon plate with set screw.

2.14 OWNER-FURNISHED FIXTURES – See schedule

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. 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.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. 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.

M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

N. Install toilet seats on water closets.

O. Install trap-seal liquid in dry urinals.

P. 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.

Q. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

R. 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.

S. Install shower flow-control fittings with specified maximum flow rates in shower arms.

T. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

U. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

V. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck. Connect inlet hose to dishwasher and outlet hose to disposer.

W. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.

X. Install escutcheons at piping wall 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."

Y. Set bathtubs, shower receptors and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

Z. 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."

3.3 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."

3.4 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.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers, hot-water dispensers and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 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 23 0500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Air Filtration
2. Piping materials and installation instructions common to most piping systems.
3. Transition fittings.
4. Dielectric fittings.
5. Mechanical sleeve seals.
6. Sleeves.
7. Escutcheons.
8. Grout.
9. HVAC demolition.
10. Equipment installation requirements common to equipment sections.
11. Painting and finishing.
12. Concrete bases.
13. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is on the “Alternate Manufacturer Evaluation Form”, subsequently approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.8 AS-BUILT DRAWINGS

A. DEFINITIONS
1. Contractor Markups – Drawings that are marked and annotated to show the project As-Built and constructed by the contractor. They are part of the working as-built set.

2. As-Built Drawings – The amended “As-designed” drawing revised to show the project as the contractor built and constructed it. The revisions from Contractor Markups and field inspection notes are transferred to the Final as-built set of drawings. The final as-built drawings include modifications during construction, field requested changes, shop drawing modifications, and contractor designs, MEPCE will not provide CAD mechanical files to the Contractor.

B. DESCRIPTION OF WORK

Section includes: Administrative and procedural requirements for as-built process for contractor to follow.

C. RECORD DOCUMENT SUBMITTALS

Record As-Built Drawings: General Contractor shall maintain on-site 2 sets of as-built Contract Drawings, in Contractor Field Office. Working as-built drawings shall be kept current on a weekly basis and at least one paper set of as-built drawings shall be available on the jobsite at all times. Note that a reproduction of MEPCE’s Construction Documents with a revised title block WILL NOT be acceptable as shop drawings or record drawings.

a. Changes to Drawings, including those that involve only narrative, shall be clearly and neatly marked in red pen or pencil, and shall be noted on appropriate drawings. Changes to the Contract Drawings include:

b.
1. Changes to material or equipment for substitutions approved through the Architect/Engineer’s submittal process.
2. Where contract drawings or specifications show options or alternates, only the option selected for construction shall be shown on the final as-built prints. Cross out such words and phrases as “approved equal” and list specifically the material provided. This shall include actual make and model number of equipment installed, as well as voltage and MCA.
3. Shop drawing information.
4. RFIs and Change Order information.
5. Changes made by the Inspector to accommodate field conditions.
6. Actual location, kinds and sizes of all existing and new utility lines, especially underground lines within the construction area. Measurements shall be shown for all change of direction points and all surface or underground components such as valves, manholes, drop inlets, clean outs, meters, etc.
7. Changes in location of equipment and architectural features.
8. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler and irrigation systems.
9. All construction changes that result from the final inspection.

c. General Contractor shall note each entry with a notation referencing source of information (Example: RFI #94, CO #3, or field notes of same).
1. As-built record drawings shall be updated no less frequently than once per week.
2. Verification of current as-built record drawing status is included in the monthly payment approval process that shall be noted in the inspector’s log notes.
3. Individual(s) responsible for the verification of the as-built process shall be identified to the Architect/Engineer.

d. When completed, scanned pdf copies of the as-built drawings shall be sent to the Owner and Architect/Engineer for final approval. Compliance and delivery of the final as-built drawings will be enforced through the approval of progress payments. The quality of the final as-built drawings will be reflected in the construction contractor’s performance evaluation.

D. MARK-UP GUIDELINE

The following information is provided to improve the quality of the marked-up prints and thereby facilitate preparation of final as-built drawings. The most important guideline is that the marked-up changes on the prints shall be complete and understandable.

1. Frequently use written explanation on As-Built drawings to describe changes. Do not rely totally on graphic means to convey the revision.
2. Legibility of lettering and digit values shall be clean and clear and readable from a scanned copy.
3. Whenever a revision is made, make changes to affect related section views, details, legend, plans and elevation view, schedules, notes and call-out designations, and mark accordingly to avoid conflicting data on all other sheets.
4. When changes are required on small-scale drawings or on drawings with limited area available, large-scale inserts shall be drawn or sketched, with leaders to the location where applicable.
5. When attached prints (or sketches) are provided with marked-up print, indicate whether:
    a. Entire drawing shall be added to contract drawings or
    b. Whether the contract drawings shall be changed to agree, or
    c. For reference only to further details not required for initial design.
6. Make the comments on the drawing complete without reference to letters, memo's or materials that are not also a part of the As-Built. For instance, do not just say, "As per Change Order #12", when the actual change order states, "Changed water pipe from 2-1/2" to 3". This also applies for changes as per the Architect/Engineer, Owner or Inspector.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
    1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 AIR FILTRATION

A. Provide air filtration in every air handling system.

B. General Contractor to shall replace Filter media at substantial completion in areas affected by construction.

2.3 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.4 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

    1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.5 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
1. Manufacturers:
a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.6 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Watts Industries, Inc.; Water Products Div.
c. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Epco Sales, Inc.
c. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Central Plastics Company.
c. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.

2.7 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Metraflex Co.
c. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
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.

2.8 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.9 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. Split-Casting, Deep pattern: With concealed hinge, set screw or spring clips, and chrome-plated finish.

C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

D. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

E. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.10 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Divisions 2 and 23 for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
8. Controls to be removed and reconnected: When controls are removed form a piece of equipment and are to be reused, the removal and reconnection shall be by the controls contractor. If the original wire is not of sufficient length to make the reconnect, a new control wire shall be used. Splicing of control wires to make the connection is not allowed.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. 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 Coordination Drawings.

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 to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: Split-case, deep-pattern type.
b. Chrome-Plated Piping: Split case, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: Split-case, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split case, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-case, cast-brass type with polished chrome-plated finish.
g. Bare Piping in Unfinished Service Spaces: Split-case, stamped-steel type with exposed-rivet hinge and set screw.
h. Bare Piping in Equipment Rooms: Split-case, stamped-steel type with set screw or spring clips.
i. Bare Piping at Floor Penetrations in Equipment Rooms: Split-case, floor-plate type.

2. Existing Piping: Use the following:

a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
g. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
h. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
i. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. 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.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. 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.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

S. Provide air eliminators on the Chilled and Heating water systems.

T. Locate manual air vents on high points in piping exterior to the building

U. Locate automatic air vent at high points in the piping and at main air handling units connections

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project. Coordinate with Structural Engineer.

1. Construct concrete bases shall be at least 4” larger than mounted equipment on all sides.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete" or "Miscellaneous Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 23 0519

THERMOMETERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.
4. Flowmeters.
5. Thermal-energy meters.

B. Related Sections:
1. Division 23 Section "Facility Natural-Gas Piping" for gas meters.

1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers, gages, flowmeters and thermal-energy meters indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer, gage, Flowmeter and thermal-energy meter, signed by product manufacturer.

D. Operation and Maintenance Data: For flowmeters and thermal-energy meters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Trerice, H. O. Co.
2. Weiss Instruments, Inc.
3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Description: Metal-Case, Liquid-In-Glass Thermometers.

C. Case: Die-cast aluminum or brass, 7 inches long.

D. Tube: Red or blue reading, mercury or organic-liquid filled, with magnifying lens.

E. Tube Background: Satin-faced, non-reflective aluminum with permanently etched scale markings.

F. Window: Glass or plastic.

G. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

H. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

I. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

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 products by one of the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. KOBOLD Instruments, Inc.
5. Marsh Bellofram.
6. Palmer - Wahl Instruments Inc.
7. Trerice, H. O. Co.
8. Weiss Instruments, Inc.
9. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

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, 4-1/2-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, non-reflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass or plastic.
8. Ring: Metal.
9. Accuracy: Grade B, plus or minus 2 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.

2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

2.5 WAFER-ORIFICE FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Inc.; ABB Instrumentation.
2. Armstrong Pumps, Inc.
3. Badger Meter, Inc.; Industrial Div.
4. Bell & Gossett; ITT Industries.
5. Meriam Instruments Div.; Scott Fetzer Co.

B. Description: Differential-pressure-design orifice insert for installation between pipe flanges; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

C. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.

D. Pressure Rating: 300 psig.

E. Temperature Rating: 250 deg F.

F. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.

G. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch-diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.

H. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot (3.7-m) hoses in carrying case.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.

I. Operating Instructions: Include complete instructions with each flowmeter.

2.6 VENTURI FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps, Inc.
2. Badger Meter, Inc.; Industrial Div.
3. Bailey-Fischer & Porter Co.
4. Flow Design, Inc.
5. Gerand Engineering Co.
6. Hyspan Precision Products, Inc.
7. Leeds & Northrup.
8. McCrometer, Inc.
9. Preso Meters Corporation.
10. Victaulic Co. of America.

B. Description: Differential-pressure design for installation in piping; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

C. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data.

D. Pressure Rating: 250 psig.

E. Temperature Rating: 250 deg F

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged or welded.

H. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.

I. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch-diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.

J. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot hoses in carrying case.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.

K. Operating Instructions: Include complete instructions with each flowmeter.

2.7 TURBINE FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Badger Meter, Inc.; Industrial Div.
2. Bailey-Fischer & Porter Co.

3. Data Industrial Corp.
4. Engineering Measurements Company.
5. ERDCO Engineering Corp.
6. Fischer, George Inc.
7. Hoffer Flow Controls, Inc.
8. ISTEC Corporation.
9. Midwest Instruments & Controls Corp.
10. ONICON Incorporated.
11. SeaMetrics Inc.
12. Sponsler Company, Inc.
13. Thermo Measurement Ltd.
14. Venture Measurement.

B. Description: Insertion type for inserting turbine into piping and measuring flow directly in gallons per minute.

C. Construction: Bronze or stainless-steel body; with plastic turbine or impeller and integral direct-reading scale.

D. Pressure Rating: 150 psig minimum.

E. Temperature Rating: 180 deg F minimum.

F. Display: Visual instantaneous rate of flow, with register to indicate total volume in gallons.

G. Accuracy: Plus or minus 2-1/2 percent.

2.8 VORTEX-SHEDDING FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bailey-Fischer & Porter Co.
2. Engineering Measurements Company.
3. ISTEC Corporation.
4. MCO/Eastech, Inc.
5. Schlumberger Limited; Measurement Div.
6. Venture Measurement.

B. Description: Inline type for installing between pipe flanges and measuring flow directly in gallons per minute.

C. Construction: Stainless-steel body; with integral transmitter and direct-reading scale.

D. Pressure Rating: 1000 psig minimum.

E. Temperature Rating: 500 deg F minimum.

F. Display: Visual instantaneous rate of flow, with register to indicate total volume in gallons.

G. Integral Transformer: For low-voltage power operation.

H. Accuracy: Plus or minus 7/10 percent for liquids and 1-1/4 percent for gases.

2.9 PITOT-TUBE FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dieterich Standard Inc.
2. Meriam Instruments Div.; Scott Fetzer Co.
3. Preso Meters Corporation.
4. Taco, Inc.
5. Veris Industries.

B. Description: Insertion-type, differential-pressure design for inserting probe into piping and measuring flow directly in gallons per minute.

C. Construction: Stainless-steel probe of length to span inside of pipe; with integral transmitter and direct-reading scale.

D. Pressure Rating: 150 psig minimum.

E. Temperature Rating: 250 deg F minimum.

F. Display: Visual instantaneous rate of flow, with register to indicate total volume in gallons.

G. Integral Transformer: For low-voltage power connection.

H. Accuracy: Plus or minus 1 percent for liquids and gases.

2.10 FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brooks Instrument Div.; Emerson Electric Co.
2. Dwyer Instruments, Inc.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. McCrometer, Inc.
6. OPW Engineered Systems; Dover Corp.
7. Penberthy, Inc.

B. Description: Instrument for installation in piping systems for visual verification of flow.

C. Construction: Bronze or stainless-steel body; with sight glass and plastic pelton-wheel indicator, and threaded or flanged ends.

D. Pressure Rating: 125 psig.

E. Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

2.11 INSERTION-TURBINE, THERMAL-ENERGY METER SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Data Industrial Corp.
2. ONICON Incorporated.
3. Thermo Measurement Ltd.

B. Description: Flow sensor, strainer, two temperature sensors, transmitter, meter, and connecting wiring.

C. Flow Sensor: Insertion-type turbine or paddle-wheel element with corrosion-resistant-metal body and transmitter.

1. Pressure Rating: 125 psig.
2. Temperature Range: 40 to 250 deg F.

D. Meter: Solid-state integrating type with integral battery pack.

1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
2. Accuracy: Plus or minus **1** percent.
3. Battery Pack: Five-year lithium battery.

E. Strainer: Full size of main line piping.

2.12 INLINE-TURBINE, THERMAL-ENERGY METER SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Engineering Measurements Company.
2. Hoffer Flow Controls, Inc.
3. ISTEC Corporation.
4. Thermo Measurement Ltd.
5. Venture Measurement.

B. Description: Flow sensor, strainer, two temperature sensors, transmitter, meter, and connecting wiring.

C. Flow Sensor: Turbine-type water meter with corrosion-resistant-metal body and transmitter.

1. Pressure Rating: 150-psig minimum working-pressure rating.
2. Temperature Range: 40 to 250 deg F.

D. Meter: Solid-state integrating type with integral battery pack.

1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
2. Accuracy: Plus or minus **1** percent.
3. Battery Pack: Five-year lithium battery.

E. Strainer: Full size of main line piping.

2.13 ULTRASONIC, THERMAL-ENERGY METER SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Controlotron Corporation.
2. Engineering Measurements Company.
3. Mesa Laboratories, Inc.; Nusonics Div.

B. Description: Flow sensor, two temperature sensors, transmitter, meter, and connecting wiring.

C. Flow Sensor: Strap-on or integral ultrasonic type with transmitter.

D. Meter: Solid-state integrating type with integral battery pack.

1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
2. Accuracy: Plus or minus **1** percent.
3. Battery Pack: Five-year lithium battery.

E. Strainer: Full size of main line piping.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. Inlet and outlet of each hydronic heat exchanger.
5. Inlet and outlet of each hydronic heat-recovery unit.
6. Inlet and outlet of each thermal storage tank.
7. Suction and discharge of each pump.

B. Provide the following temperature ranges for thermometers:

1. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
2. Condenser Water: 0 to 160 deg F, with 2-degree scale divisions .
3. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.
4. Steam and Condensate: 35 to 300 deg F, with 5-degree scale divisions.
5. Air Ducts: 40 to plus 120 deg F, with 2-degree scale divisions.
6. Domestic Hot Water: 30 to 180°F, with 2-degree scale divisions.
7. Domestic Cold Water: 0 to 100° F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install pressure gages for inlet and discharge of each pressure-reducing valve.

B. Install pressure gages at chilled- and condenser-water inlets and outlets of chillers.

C. Install pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.

C. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.

D. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

E. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

F. Install remote-mounting pressure gages on panel.

G. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).

H. Install needle-valve and siphon fitting in piping for each pressure gage for steam.

I. Install test plugs in tees in piping.

J. Install flow indicators, in accessible positions for easy viewing, in piping systems.

K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.

L. Install flowmeter elements in accessible positions in piping systems.

M. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.

N. Install wafer-orifice flowmeter elements between pipe flanges.

O. Install permanent indicators on walls or brackets in accessible and readable positions.

P. Install connection fittings for attachment to portable indicators in accessible locations.

Q. Install flowmeters at discharge of hydronic system pumps and at inlet of hydronic air coils.

R. Assemble components and install thermal-energy meters.

S. Mount meters on wall if accessible; if not, provide brackets to support meters.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy-meter transmitters to meters.

3.5 ADJUSTING

A. Calibrate meters 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 23 0523

GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following general-duty valves:
1. Copper-alloy ball valves.
2. Ferrous-alloy butterfly valves.
3. Bronze check valves.
4. Gray-iron swing check valves.
5. Ferrous-alloy wafer check valves.
6. Spring-loaded, lift-disc check valves.
7. Bronze gate valves.
8. Cast-iron gate valves.
9. Bronze globe valves.

B. Related Sections include the following:

1. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
2. Division 23 piping Sections for specialty valves applicable to those Sections only.
3. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and charts.
4. Division 23 Section "Instrumentation and Control for HVAC" for control valves and actuators.

1.2 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. PTFE: Polytetrafluoroethylene plastic.
4. SWP: Steam working pressure.
5. TFE: Tetrafluoroethylene plastic.

1.3 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.4 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Ball Valves: All ball valves shall be full port with stainless steel ball unless otherwise indicated.

C. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

D. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

G. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 and smaller.

H. Extended Valve Stems: On insulated valves.

I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

J. Valve Grooved Ends: AWWA C606.

K. Threaded: With threads according to ASME B1.20.1.

L. Valve Bypass and Drain Connections: MSS SP-45.

2.2 COPPER-ALLOY BALL VALVES

A. Manufacturers:

1. Two-Piece, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Jamesbury, Inc.
h. Jomar International, LTD.
i. Milwaukee Valve Company.
j. Nexus Valve Specialties.
k. NIBCO INC.
l. R & M Energy Systems (Borger, TX).
m. Red-White Valve Corp.
n. Watts Industries, Inc.; Water Products Div.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper-Alloy Ball Valves: Forged-brass body with full-port, stainless steel ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

2.3 FERROUS-ALLOY BUTTERFLY VALVES

A. Manufacturers:

1. Single-Flange, Ferrous-Alloy Butterfly Valves:

a. American Valve, Inc.
b. Bray International, Inc.
c. Cooper Cameron Corp.; Cooper Cameron Valves Div.
d. Crane Co.; Crane Valve Group; Center Line.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Div.
g. Dover Corp.; Dover Resources Company; Norriseal Div.
h. General Signal; DeZurik Unit.
i. Grinnell Corporation.
j. Hammond Valve.
k. Kitz Corporation of America.
l. Legend Valve & Fitting, Inc.
m. Metraflex Co.
n. Milwaukee Valve Company.
o. Mueller Steam Specialty.
p. NIBCO INC.
q. Process Development & Control.
r. Red-White Valve Corp.
s. Techno Corp.
t. Tyco International, Ltd.; Tyco Valves & Controls.
u. Watts Industries, Inc.; Water Products Div.

2. Flanged, Ferrous-Alloy Butterfly Valves:

a. Bray International, Inc.
b. Cooper Cameron Corp.; Cooper Cameron Valves Div.

c. Grinnell Corporation.
d. Mueller Steam Specialty.
e. Tyco International, Ltd.; Tyco Valves & Controls.

3. Grooved-End, Ductile-Iron Butterfly Valves:

a. Central Sprinkler Co.; Central Grooved Piping Products.
b. Grinnell Corporation.
c. Hammond Valve.
d. McWane, Inc.; Kennedy Valve Div.
e. Milwaukee Valve Company.
f. Mueller Steam Specialty.
g. NIBCO INC.

B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.

C. Single-Flange, 150-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.

D. Flanged, 150-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two- piece stem.

E. Grooved-End, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.

2.4 BRONZE CHECK VALVES

A. Manufacturers:

1. Horizontal Lift Check Valves with Metal Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. Red-White Valve Corp.
e. Walworth Co.

2. Vertical Lift Check Valves with Metal Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Red-White Valve Corp.

3. Swing Check Valves with Metal Disc:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.
j. Milwaukee Valve Company.

k. NIBCO INC.
l. Powell, Wm. Co.
m. Red-White Valve Corp.
n. Walworth Co.
o. Watts Industries, Inc.; Water Products Div.

B. Bronze Check Valves, General: MSS SP-80.

C. Class 125, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

D. Class 125, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

E. Class 125, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

2.5 GRAY-IRON SWING CHECK VALVES

A. Manufacturers:

1. Type I, Gray-Iron Swing Check Valves with Metal Seats:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valve
c. Crane Co.; Crane Valve Group; Jenkins Valv
d. Crane Co.; Crane Valve Group; Stockham D
e. Flomatic Valves.
f. Grinnell Corporation.
g. Hammond Valve.
h. Milwaukee Valve Company.
i. Mueller Co.
j. NIBCO INC.
k. Powell, Wm. Co.
l. Red-White Valve Corp. m. Walworth Co.
m. Watts Industries, Inc.; Water Products Div.

2. Grooved-End, Ductile-Iron Swing Check Valves:

a. Grinnell Corporation.
b. Mueller Co.

B. Gray-Iron Swing Check Valves, General: MSS SP-71.

C. Type II, Class 125, gray-iron, swing check valves with composition to metal seats.

D. Type II, Class 250, gray-iron, swing check valves with composition to metal seats.

E. 175-psig CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.6 FERROUS-ALLOY WAFER CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Gulf Valve Co.
c. Valve and Primer Corp.

2. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Gulf Valve Co.
c. Techno Corp.

C. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

D. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.

E. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

2.7 SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Manufacturers:

1. Wafer Lift-Disc Check Valves:
a. Durabla Fluid Technology, Inc.
b. Flomatic Valves.
c. GA Industries, Inc.
d. Grinnell Corporation.
e. Hammond Valve.
f. Metraflex Co.
g. Milwaukee Valve Company.
h. Mueller Steam Specialty.
i. Multiplex Manufacturing Co.
j. NIBCO INC.
k. SSI Equipment, Inc.
l. Val-Matic Valve & Mfg. Corp.
m. Valve and Primer Corp.

B. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

C. Class 125, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter made to fit within bolt circle.

2.8 BRONZE GATE VALVES

A. Manufacturers:

1. Type 1, Bronze, Nonrising-Stem, Gate Valves:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.

j. Milwaukee Valve Company.
k. NIBCO INC.
l. Powell, Wm. Co.
m. Red-White Valve Corp.
n. Walworth Co.
o. Watts Industries, Inc.; Water Products Div.

2. Type 2, Bronze, Rising-Stem, Gate Valves:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Powell, Wm. Co.
l. Red-White Valve Corp.
m. Walworth Co.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge and union- ring bonnet.

D. Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze solid or split wedge and union-ring bonnet.

2.9 CAST-IRON GATE VALVES

A. Manufacturers:

1. Cast-Iron, Nonrising-Stem Gate Valves:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Kitz Corporation of America.
h. Legend Valve & Fitting, Inc.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Powell, Wm. Co.
l. Red-White Valve Corp.
m. Walworth Co.
n. Watts Industries, Inc.; Water Products Div.

2. Type I, Cast-Iron, Rising-Stem Gate Valves:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.

e. Grinnell Corporation.
f. Hammond Valve.
g. Kitz Corporation of America.
h. Legend Valve & Fitting, Inc.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Powell, Wm. Co.
l. Red-White Valve Corp.
m. Walworth Co.
n. Watts Industries, Inc.; Water Products Div.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

C. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.

D. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Equipment isolation Service: Ball, butterfly, or gate valves.
2. Shutoff Service: Gate Valves
   a. (For main line shutoff. Slow gate vales prevent water hammer.)
3. Throttling Service: Ball or control valves.
4. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Chilled-, Condenser-, and Heating Hot-Water Piping: Use the following types of valves:
1. Ball Valves, NPS 2 and Smaller: Two or Three-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange or Flanged, 150-psig CWP rating for dead-end service, ferrous alloy, with EPDM liner.
4. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
5. Lift Check Valves, NPS 2 and Smaller: Class 125 or 150, horizontal or vertical, bronze.
6. Swing Check Valves, NPS 2 and Smaller: Class 125 or 150, bronze.
7. Swing Check Valves, NPS 2-1/2 and Larger: Class 125, gray iron.
8. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
9. Wafer Check Valves, NPS 2-1/2 and Larger: Dual-plate, wafer-lug or double-flanged, Class 125 or 150 ferrous alloy.
10. Spring-Loaded, Lift-Disc Check Valves: Class 125 or 250, cast iron.
11. Gate Valves, NPS 2 and Smaller: Class 125 or 150, bronze.
12. Gate Valves, NPS 2-1/2 and Larger: Class 125, NRS or OS&Y, bronze-mounted cast iron.

D. Select valves, except wafer and flangeless types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded ends.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 and larger: Flanged, grooved, or threaded ends.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Common Work Results for HVAC" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.5 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 23 0529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Metal framing systems.
3. Thermal-hanger shield inserts.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
3. Division 23 Section(s) "Metal Ducts" and "Nonmetal Ducts" for duct hangers and supports.
4. Division 23 Section(s) for vibration isolation restraint devices.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. 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, including pipe stands, 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.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Channel support system components.
3. Thermal-hanger shield inserts.

B. Shop Drawings: Provide shop drawings for each location required for multiple piping supports and trapeze hangers. Provide manufacturer’s catalog data including load capacity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
   1. Pipe Hangers:
      a. AAA Technology and Specialties Co., Inc.
      b. B-Line Systems, Inc.
      c. Grinnell Corp.
      d. National Pipe Hanger Corp.
      e. PHD Manufacturing, Inc.
   2. Channel Support Systems:
      a. B-Line Systems, Inc.
      b. Grinnell Corp.; Power-Strut Unit.
      c. National Pipe Hanger Corp.
      d. Unistrut Corp.
   3. Thermal-Hanger Shield Inserts:
      a. Carpenter & Patterson, Inc.
      b. Michigan Hanger Co., Inc.
      c. PHS Industries, Inc.
      d. Pipe Shields, Inc.

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. Galvanized, Metallic Coatings: Pregalvanized or hot dipped. For piping and equipment that will not have field-applied finish.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner. On attachments for electrolytic protection where attachments are in direct contact with copper or other metal tubing.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 CHANNEL SUPPORT SYSTEMS

A. Description: MFMA-2, factory-fabricated components for field assembly.

B. Coatings: Manufacturer's standard painted finish or galvanized finish.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner. On attachments for electrolytic protection where attachments are in direct contact with copper or other metal tubing.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated,ASTM C 533, Type I calcium silicate with vapor barrier.

C. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated,ASTM C 533, Type I calcium silicate.

D. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

E. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

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. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
6. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
9. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
10. 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.

11. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
12. 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.
13. 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 not necessary.
14. 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.

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.
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.

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-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
10. 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.

11. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

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, 360-degree insert of high- density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or
    a. Cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

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.

3.2 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. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
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 D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

H. Insulated Piping: Comply with the following:

1. Install MSS SP-58, Type 39, protection saddles. 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.

2. 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.

3. Pipes NPS 8 and Larger: Include wood inserts.
4. Insert Material: Length at least as long as protective shield.
5. 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. 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.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

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 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Equipment nameplates.
2. Equipment markers.
3. Access panel and door markers.
4. Pipe markers.
5. Stencils.
6. Valve Tags
7. Valve Schedules
8. Warning tags.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. For all HVAC equipment located above ceilings, provide laminated identification tags on ceiling grid below to identify unit name and number as defined by the construction documents. Tags should be laminated plastic and fastened to ceiling grid with rivets and not adhesive.

B. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
   a. Manufacturer, product name, model number, and serial number.
   b. Capacity, operating and power characteristics, and essential data.
2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

C. Equipment Markers: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2. Fabricate in sizes required for message

1. Terminology: Match schedules as closely as possible.
2. Data:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
4. Fasteners: Self-tapping, stainless-steel screws.

D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws.

2.2 PIPE IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, alkyd enamel or acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel or acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 VALVE TAGS

1. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2- inch numbers, with numbering scheme approved by Architect or Engineer. Provide 5/32-inch hole for fastener.
   a. Material: 0.032-inch- thick brass or aluminum.
   b. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.5 VALVE SCHEDULES

1. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal- operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   a. Valve-Schedule Frames: 30”x42” display frame for mounting on masonry walls for each page of valve schedule. Include mounting screws.
   b. Provide one each for every mechanical equipment room.
   c. Frame: Extruded aluminum.
   d. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is installer’s option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
4. Fans, blowers, primary balancing dampers, and mixing boxes.
5. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with mechanical fasteners on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24inches, 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.
2. Each rooftop unit shall have an identification tag indicating the unit number shown on the construction drawings, the room number that the unit serves and the circuit number serving the rooftop unit. The tag shall be plastic laminate, black background with 1.0” tall white letters for the unit number and 0.5” tall white letters for the other information, refer to example below. The tag shall be attached to the unit using sheet metal screws on each corner.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets
   b. Fire department hose valves and hose stations.
   c. Meters, gages, thermometers, and similar units.
   d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
   e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
   g. Fans, blowers, primary balancing dampers, and mixing boxes.
   h. Packaged HVAC central-station and zone-type units.
   i. Tanks and pressure vessels.
   j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
5. For all HVAC equipment located above ceilings, provide laminated identification tags on ceiling grid below to identify unit name and number as defined by the construction documents. Tags should be laminated plastic and fastened to ceiling grid with rivets and not adhesive.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated p lastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

D. Install access panel markers with screws on equipment access panels.

3.3 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.4 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.5 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:
    a. Constant-volume air systems.
    b. Variable-air-volume systems.
2. Hydronic Piping Systems:
    a. Variable-flow systems.
    b. Primary-secondary systems.
3. Exhaust hood airflow balancing.
4. Sound level measuring.
5. Existing systems TAB.
6. Verifying that automatic control devices are functioning properly.
7. Reporting results of activities and procedures specified in this Section.

1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

K. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.

L. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

M. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

P. TAB: Testing, adjusting, and balancing.

Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

R. Test: A procedure to determine quantitative performance of systems or equipment.

S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.3 SUBMITTALS

A. Qualification Data: Within 15 days from Contractor's Notice to Proceed, submit 2 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days from Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 2 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by AABC.

B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements.
b. The Contract Documents examination report.
c. TAB plan.
d. Work schedule and Project-site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems".

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.5 PROJECT 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.

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

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.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

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 equipment performance data including fan and pump curves. 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. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine system pumps to ensure absence of entrained air in the suction piping.

Q. Examine equipment for installation and for properly operating safety interlocks and controls.

R. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

S. 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 strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 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' "as-built" 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 outside-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.

L. Check for proper sealing of air duct system.

3.5 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 fan static pressures to determine actual static pressure as follows:

    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. 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 will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance systems similar to constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.

7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS

A. Balance the primary system crossover flow first, then balance the secondary system.

3.11 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.12 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.13 PROCEDURES FOR BOILERS

A. If hydronic, measure entering- and leaving-water temperatures and water flow.

B. If steam, measure entering-water temperature and flow and leaving steam pressure, temperature, and flow.

3.14 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.15 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.16 PROCEDURES FOR EXHAUST HOODS

A. Measure, adjust, and record the airflow of each exhaust hood. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, explain why, in the report, and explain the test method used.

B. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood exhaust-duct connection.
2. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to achieve optimum results.

3.17 PROCEDURES FOR SOUND-LEVEL MEASUREMENTS

A. Perform sound-pressure-level measurements with an octave-band analyzer complying with ANSI S1.4 for Type 1 sound-level meters and ANSI S1.11 for octave-band filters. Comply with requirements in ANSI S1.13, unless otherwise indicated.

B. Calibrate sound meters before each day of testing. Use a calibrator provided with the sound meter complying with ANSI S1.40 and that has NIST certification.

C. Use a microphone that is suitable for the type of sound levels measured. For areas where air velocities exceed 100 fpm, use a windscreen on the microphone.

D. Perform sound-level testing after air and water balancing and equipment testing are complete.

E. Close windows and doors to the space.

F. Perform measurements when the space is not occupied and when the occupant noise level from other spaces in the building and outside are at a minimum.

G. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.

H. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, and other large surface capable of altering the measurements.

I. Take sound measurements in dBA and in each of the 8 unweighted octave bands in the frequency range of 63 to 8000 Hz.

J. Take sound measurements with the HVAC systems off to establish the background sound levels and take sound measurements with the HVAC systems operating.

1. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.

K. Perform sound testing at locations on Project for each of the following space types. For each space type tested, select a measurement location that has the greatest sound level. If testing multiple locations for each space type, select at least one location that is near and at least one location that is remote from the predominant sound source.

1. Auditoriums or Lecture halls.
2. Drama, Blackbox, or Performing Arts spaces.
3. Library or Media Room spaces.
4. Band or Music Classrooms.
5. Each space with a noise criterion of RC or NC 25 or lower.
6. Each space with an indicated noise criterion of RC or NC 35 and lower that is adjacent to a mechanical equipment room or roof mounted equipment.

3.18 PROCEDURES FOR INDOOR-AIR QUALITY MEASUREMENTS

A. After air balancing is complete and with HVAC systems operating at indicated conditions, perform indoor-air quality testing.

B. Observe and record the following conditions for each HVAC system:

1. The distance between the outside-air intake and the closest exhaust fan discharge, cooling tower, flue termination, or vent termination.

2. Specified filters are installed. Check for leakage around filters.
3. Cooling coil drain pans have a positive slope to drain.
4. Cooling coil condensate drain trap maintains an air seal.
5. Evidence of water damage.
6. Insulation in contact with the supply, return, and outside air is dry and clean.

C. Measure and record indoor conditions served by each HVAC system. Make measurements at multiple locations served by the system if required to satisfy the following:

1. Most remote area.
2. One location per floor.
3. One location for every 5000 sq. ft..

D. Measure and record the following indoor conditions for each location two times at two-hour intervals, and in accordance with ASHRAE 113:

1. Temperature.
2. Relative humidity.
3. Air velocity.
4. Concentration of carbon dioxide (ppm).
5. Concentration of carbon monoxide (ppm).
6. Nitrogen oxides (ppm).
7. Formaldehyde (ppm).

3.19 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.

4. Air balance each air outlet.

3.20 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.21 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Heating-Water Flow Rate: 0 to minus 10 percent.
4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.22 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 systems' balancing devices. Recommend changes and additions to systems' 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: As Work progresses, prepare 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.

3.23 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
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 firm 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, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

a. Settings for outside-, return-, and exhaust-air dampers.
b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.
d. Face and bypass damper settings at coils.
e. Fan drive settings including settings and percentage of maximum pitch diameter.
f. Inlet vane settings for variable-air-volume systems.
g. Settings for supply-air, static-pressure controller.
h. Other system operating conditions that affect performance.

E. 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 outside, 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.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

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. Sheave dimensions, center-to-center, and amount of adjustments in inches.
j. Number of belts, make, and size.
k. Number of filters, type, and size.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, 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 rpm.
d. Discharge static pressure in inches wg.
e. 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. Outside airflow in cfm.
j. Return airflow in cfm.
k. Outside-air damper position.
l. Return-air damper position.
m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.

j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

H. 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 Btuh.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Sheave dimensions, center-to-center, 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 Btuh.
i. High-fire fuel input in Btuh.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btuh.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btuh.

I. 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 Btuh.
    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 Btuh.
    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.

J. 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. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

    a. Make and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Suction static pressure in inches wg.

K. 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 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.

L. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device 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.

M. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

N. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Unit make and model number.
d. Compressor make.
e. Compressor model and serial numbers.
f. Refrigerant weight in lb.
g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):

a. Inlet-duct static pressure in inches wg.
b. Outlet-duct static pressure in inches wg.
c. Entering-air, dry-bulb temperature in deg F.
d. Leaving-air, dry-bulb temperature in deg F.
e. Condenser entering-water temperature in deg F.
f. Condenser leaving-water temperature in deg F.
g. Condenser-water temperature differential in deg F.
h. Condenser entering-water pressure in feet of head or psig.
i. Condenser leaving-water pressure in feet of head or psig.
j. Condenser-water pressure differential in feet of head or psig.
k. Control settings.
l. Unloader set points.
m. Low-pressure-cutout set point in psig.
n. High-pressure-cutout set point in psig.
o. Suction pressure in psig.
p. Suction temperature in deg F.
q. Condenser refrigerant pressure in psig.
r. Condenser refrigerant temperature in deg F.
s. Oil pressure in psig.
t. Oil temperature in deg F.
u. Voltage at each connection.
v. Amperage for each phase.
w. Kilowatt input.
x. Crankcase heater kilowatt.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm.
bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.
dd. Condenser fan motor amperage for each phase.

O. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model and serial numbers.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.

o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

P. Boiler Test Reports:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and type.
e. Model and serial numbers.
f. Fuel type and input in Btuh.
g. Number of passes.
h. Ignition type.
i. Burner-control types.
j. Voltage at each connection.
k. Amperage for each phase.

2. Test Data (Indicated and Actual Values):

a. Operating pressure in psig.
b. Operating temperature in deg F.
c. Entering-water temperature in deg F.
d. Leaving-water temperature in deg F.
e. Number of safety valves and sizes in NPS.
f. Safety valve settings in psig.
g. High-limit setting in psig.
h. Operating-control setting.
i. High-fire set point.
j. Low-fire set point.
k. Voltage at each connection.
l. Amperage for each phase.
m. Draft fan voltage at each connection.
n. Draft fan amperage for each phase.
o. Manifold pressure in psig.

Q. Sound Measurement Reports: Record sound measurements on octave band and dBA test forms and on an NC or RC chart indicating the decibel level measured in each frequency band for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms:

1. Date and time of test. Record each tested location on its own NC curve.
2. Sound meter manufacturer, model number, and serial number.
3. Space location within the building including floor level and room number.

4. Diagram or color photograph of the space showing the measurement location.
5. Time weighting of measurements, either fast or slow.
6. Description of the measured sound: steady, transient, or tonal.
7. Description of predominant sound source.

R. Indoor-Air Quality Measurement Reports for Each HVAC System:

1. HVAC system designation.
2. Date and time of test.
3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
4. Room number or similar description for each location.
5. Measurements at each location.
6. Observed deficiencies.

S. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.24 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Measure sound levels at two locations.
e. Measure space pressure of at least 10 percent of locations.
f. Verify that balancing devices are marked with final balance position.
g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the 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."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.

7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.25 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing 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 testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

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SECTION 23 0700

HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
   a. Flexible Elastomeric
   b. Mineral fiber.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Lagging adhesives.
7. Sealants.
8. Factory-applied jackets.
9. Field-applied fabric-reinforcing mesh.
10. Field-applied cloths.
11. Field-applied jackets.
12. Tapes.
13. Securements.
14. Corner angles.

B. Related Sections:
1. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

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. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Sample Sizes:

a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2 .
b. Sheet Form Insulation Materials: 12 inches square.
c. Jacket Materials for Pipe: 12 inches long by NPS 2 .
d. Sheet Jacket Materials: 12 inches square.
e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

F. Field quality-control reports.

G. Application Schedule: Provide schedule of intended application for each product indicated. Schedule to include at minimum duct/pipe system, installed location, duct/pipe size, insulation material, and insulation thickness for each application.
1. Example application schedule (Note: sizes and materials listed are examples only. Refer to specifications Part-2 Products and Part-3 Execution for full description of required materials.)

SYSTEM	LOCATION	SIZE	INSULATION MATERIAL	INSULATION THICKNESS
Concealed supply, return, outside air duct, and tops of diffusers	INDOOR	N/A	Mineral-Fiber Exterior Wrapped Insulation	1/2"
Exposed supply, return, outside air duct.	INDOOR	N/A	Flexible Elastomeric Interior Lining	1"
Chilled Water Piping	INDOOR	NPS 1-1/2" and larger	Flexible Elastomeric	1-1/2"

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. 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.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 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 C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; All-Service Duct Wrap.

H. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
1. Products: Subject to compliance with requirements, provide one of the following

    a. Johns Manville; HTB 23 Spin-Glas.
    b. Owens Corning; High Temperature Flexible Batt Insulations.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications,with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Commercial Board.
    b. Fibrex Insulations Inc.; FBX.
    c. Johns Manville; 800 Series Spin-Glas.
    d. Knauf Insulation; Insulation Board.
    e. Manson Insulation Inc.; AK Board.
    f. Owens Corning; Fiberglas 700 Series.

J. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; FBX.
    b. Johns Manville; 1000 Series Spin-Glas.
    c. Owens Corning; High Temperature Industrial Board Insulations.
    d. Rock Wool Manufacturing Company; Delta Board.
    e. Roxul Inc.; Roxul RW.
    f. Thermafiber; Thermafiber Industrial Felt.

K. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000 Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

L. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Knauf Insulation; Permawick Pipe Insulation.
    b. Owens Corning; VaporWick Pipe Insulation.

M. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, 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. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

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 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.
1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; FlameChek.
    b. Johns Manville; Firetemp Wrap.
    c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
    d. Thermal Ceramics; FireMaster Duct Wrap.
    e. 3M; Fire Barrier Wrap Products.
    f. Unifrax Corporation; FyreWrap.
    g. Vesuvius; PYROSCAT FP FASTR Duct Wrap.

2.3 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, provide one of the following:

    a. Insulco, Division of MFS, Inc.; Triple I.
    b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
1. Products: Subject to compliance with requirements, provide one of the following:

    a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
1. Products: Subject to compliance with requirements, provide one of the following:

    a. Insulco, Division of MFS, Inc.; SmoothKote.
    b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    c. Rock Wool Manufacturing Company; Delta One Shot.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

D. 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. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Red Devil, Inc.; Celulon Ultra Clear.

2.5 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; Encacel.
b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
c. Marathon Industries, Inc.; 570.
d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.6 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.7 SEALANTS

A. Joint Sealants:
1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.

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. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

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. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76.

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.

2.8 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 C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
6. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.9 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Vimasco Corporation; Elastafab 894.

B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd.with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; Chil-Glas No. 5.

C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
      b. Vimasco Corporation; Elastafab 894.

2.10 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
   1. Products: Subject to compliance with requirements, provide one of the following:

a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.11 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, 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 D 1784, 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. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; Metal Jacketing Systems.
b. PABCO Metals Corporation; Surefit.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 2.5-mil-thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil thick Polysurlyn.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The), Saran 540 Vapor Retarder Film.

2.12 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

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 C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

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. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.

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. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

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. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.

2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.

2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.13 SECUREMENTS

A. Bands:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers: Note that insulation pins shall NOT BE USED for cooled, dehumidified supply/return air insulation. Use for heated air systems only.

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

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.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

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.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
2) GEMCO; Press and Peel.
3) Midwest Fasteners, Inc.; Self Stick.

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.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel or aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.

4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Products: Subject to compliance with requirements, provide one of 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: 0.062-inch soft-annealed, galvanized steel.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. C & F Wire.
      b. Childers Products.
      c. PABCO Metals Corporation.
      d. RPR Products, Inc.

2.14 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, 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 B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F . Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends 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 pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. 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 Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. 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. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

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. Provide a removable waterproof jacket with a minimum R-factor = 8.0. Jacket shall be suitable for hot or chilled water pumps as required. Jacket shall allow for required maintenance on pump.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, 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, 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.

C. 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.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as 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.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch , and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. 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 1 edge and 1 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 2 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.

F. 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 1 edge and 1 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 2 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-(150-mm-) 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.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.

3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.10 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 Division 07 Section "Penetration Firestopping."

3.11 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
   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.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to two location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
   2. 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 two 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.
   3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.13 BOILER BREECHING INSULATION SCHEDULE

A. Round, exposed or concealed breeching and connector insulation shall be one of the following:

   1. Modular double wall positive pressure chimney system with stainless steel inner wall and welded galvanized steel outer wall with fire rated insulation within the wall cavity. Duct shall be rated for 2 hours and UL listed for kitchen grease exhaust, building heating and a 1400 deg.F chimney, and a maximum of 4” distance to combustible surfaces.
   2. Provide by Silkirk, Dura Vent, Metalbestos or Captive Aire

3.14 DUCT INSULATION SCHEDULE, GENERAL

A. All ductwork shall be externally insulated except as follows:
   1. First ten feet of the supply and return duct from roof mounted equipment through the roof.

2. In sound sensitive spaces within the facility such as auditoriums, libraries, band/music classrooms, etc or other areas where duct lining is recommended for sound attenuation.
3. In all occupied areas where ductwork is exposed to view.

B. 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 nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.

C. 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.

3.15 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed supply-air duct and plenum insulation shall be one of the following: (All must comply with the 2015 IEEC – Commercial section).
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

B. Concealed return-air duct and plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

3.16 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. Generally, no fiberglass or mineral fiber type insulation shall be used on cold surfaces (temperature < 60 Deg.F).

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Heating-hot-water pump insulation shall be one of the following:
1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

D. Heating-hot-water expansion/compression tank insulation shall be one of the following:
1. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.
2. Mineral-Fiber Pipe and Tank: 1 inch thick.

E. Heating-hot-water air-separator insulation shall be one of the following:
1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
2. Mineral-Fiber Pipe and Tank: 2 inches thick.

F. Piping system filter-housing insulation shall be one of the following:
1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
2. Mineral-Fiber Pipe and Tank: 2 inches thick.

3.17 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. All chilled and hot water piping shall be insulated with fiberglass insulation with factory applied all service jacket.

C. Exposed piping below twelve feet above finished floor shall have a PVC elbows and jacketing

D. Outdoor piping shall have a metal jacket and heat trace.

E. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury or if the pipes produce condensate drippage.

3.18 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water:
   a. Refer to 220700 – Plumbing Insulation.

B. Chilled Water Supply and Return Piping:

1. NPS 1-1/4 and smaller: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 thick

2. NPS 1-1/2 and larger: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1-1/2 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 thick

C. Heating Hot-Water Supply and Return Piping (200°F and below):

1. NPS 1-1/4 and smaller: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Type 1: 1-1/2 inch thick.

2. NPS 1-1/2 and larger: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Type 1: 2 inch thick

D. Condenser Water Supply and Return Piping:

1. NPS 1-1/2 and smaller: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.

2. NPS 2 and larger: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1-1/2 inch thick.

E. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.

F. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.

G. Hot Service Drains: (Personnel protection)

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

H. Hot Service Vents: (Personnel protection)

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

3.19 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1-1/2 inches thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1-1/2 inches thick.

D. Hot Service Vents: (Personnel protection)

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch thick.

3.20 MANUFACTURERS

A. Products of the following manufacturers which comply with all requirements are acceptable:

1. Perma Pipe
2. Thermal Pipe Systems, Inc.
3. Thermacor
4. Insul-Pipe

3.21 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material that does not have a factory applied jacker..

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. FSK jacket.

D. Equipment, Concealed:

1. None.

E. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches. Note that this only applies if no factory applied jacket is provided with the equipment.
1. Aluminum Corrugated 0.032 inch thick.

F. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches. Note that this only applies if no factory applied jacket is provided with the equipment.
1. Aluminum, Deep Corrugations 2-1/2-Inch- Box Ribs: 0.040 inch thick.

G. Piping, Concealed: (Note that PVC jacket is not allowed in a return air plenum)

1. None.

H. Piping, Exposed:
1. PVC 20 mils thick.

3.22 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. Same as for ducts and plenums outside, by Polyguard, FlexClad, or Thermaduct.

D. Piping, Concealed or exposed:

1. If piping is not insulated, no jacket is required.
2. If piping is insulated, provide the same weatherproofing over insulation as for exposed ducts, by Polyguard, FlexClad or Thermaduct..

E. Piping, Exposed:
1. Aluminum, Smoothwith Z-Shaped Locking Seam: 0.020 inch (0.51 mm) thick.

END OF SECTION

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SECTION 23 0925

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 Section Includes

A. Variable Frequency Drive (VFD)

B. Options, include bypass

1.2 Scope

A. This section provides specification for AC variable frequency drives or herein identified as VFD's for use with {NEMA B, NEMA D, NEMA A, NEMA E, Wound Rotor, Synchronous} design AC motors.

B. The VFD manufacturer shall furnish, test, adjust and certify all packages systems for satisfactory operation prior to shipment.

C. Any exceptions / deviations to this specification shall be indicated in writing and submitted.

1.3 References

EN 61010-1	Safety requirement for electrical equipment for measurement, control, and laboratory use. Part 1 – General Requirement.
EN 60204-1	Safety of machinery-electrical equipment of machines. Part 1 - Specification for general requirement.
EN 60950	Safety of information technology equipment including electrical business equipment.
IEC 664	Insulation coordination for equipment within low- voltage systems.
IEC 60068-2-6	Environmental testing – Part 2 – Test Fc: vibration (sinusoidal).
IEC 60068-2-27	Environmental testing. Part 2: Tests. Test Ea and guidance: Shock
IEC 801-4	Electrical Fast Transient (Supplementary Wave). IEEE C62.41 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
NEC	National Electrical Code
NEMA ICS6	Industrial control and systems enclosures. NEMA 250 Enclosures for electrical equipment
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum).
NEMA FU1	Low Voltage Cartridge Fuses.
NEMA ICS 7	Industrial Control and Systems: Adjustable Speed Drives.
NEMA ICS 7.1	Safety Standards for Construction and Guide for Se-lection, Installation, and Operation of Adjustable Speed Drive Systems.
UL 508	Industrial control equipment.

UL 508C	Power conversion equipment.
UL 508C	Testing standard
UL Type-1 or -12	As listed in the contract documents

1.4 Submittals

A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 10, General Conditions, and Division 1.

B. Product Data:

I. Provide as outlined in the contract documents previously issued:

a. General description, voltage, horsepower, max current ratings, diagrams.

b. Ratings and weights.

C. Shop Drawings:

I. Provide as outlined in the contract documents previously issued:

a. Outline dimensions.

b. Mounting points.

c. Interconnecting wiring diagrams.

D. Manufacturer's Installation Instructions:

I. Provide with each variable frequency drive at time of shipment and submittal:

a. Installation methods

b. Connection points

E. Submit product data for Variable Frequency Drive (VFD) with submittal package. Include manufacturer, dimensions, ratings, listings, elementary power and control wiring diagrams and data on features and components. Provide mounting points and connection points. Any exceptions to the specification shall be clearly noted in the submittal.

1.5 Quality Assurance

A. The VFD and options shall comply with the applicable requirements of the latest standards of ANSI, IEEE, and the National Electrical Code.

B. The VFD and options shall be tested to ANSI/UL Standard 508 and listed by a nationally recognized testing agency such as UL or ETL. Device shall bear label.

C. To ensure quality and minimize infantile failures at the jobsite, the VFD shall be “burned in” for 24- hours by the manufacturer.

D. All VFD shall be UL listed for short circuit current rating of 100 kA and UL label shall be attached accordingly.

E. All VFD system door mounted pilot devices shall be tested to verify successful oper-

ation. Documentation shall be provided upon the request of the engineer.

F. All features shall be functionally tested at the factory for proper operation.

1.6 Warranty

a. VFD shall be free from defects in materials and workmanship under normal use and service for a period of 3 year from substantial completion.

PART 2 - PRODUCTS

2.1 General

A. Manufacturers:

I. ABB

II. Danfoss

III. Trane

B. Furnish complete variable speed drives as specified herein. All standard and optional features requested shall be included within the VFD enclosure unless otherwise specified. Drives shall be for variable torque load, unless otherwise noted.

C. The variable speed drives shall convert three-phase, 60 HZ utility power to adjustable voltage and frequency, three-phase, AC power for step less motor speed control from 10% to 100% of the motor's 60 Hz speed. Input voltage shall be as specified in the schedule.

D. The VFD power input stage shall convert three-phase AC line power to a fixed DC bus voltage. This will be accomplished with a solid state three- phase full-wave diode rectifier with metal oxide varistor (MOV) three-phase protection. Displacement power factor shall not be less than 0.95 throughout the speed range. Input line inductors (3%) shall be included on the line side of the power input state for units that have saturating (non-linear) DC link reactors.

E. The VFD output power shall vary frequency to the motor from 6 to 60 Hz with resultant motor speed varying at the motor nameplate rated speed, with output voltage variation from zero to motor rated voltage for optimum volts per hertz (V/Hz) ratio for fan and pump loads. Output current shall be rated 110% of motor full load amps (FLA) for 1 minute based upon VFD's variable torque FLA rating. The output must be a voltage source type generating a sine coded PWM waveform utilizing an asynchronous carrier frequency (output transistor switching frequency is to be independent of drive output frequency). This carrier frequency shall be adjustable to minimize harmonically induced noise or vibration.

F. All VFD shall contain integral EMI filters to attenuate radio frequency interference conducted to the AC power line.

G. VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.

2.2 Features

A. The VFD shall include the following features:

I. The VFD shall be housed in a NEMA 1 enclosure for indoor applications.

II. The VFD shall be housed in a NEMA 3R enclosure for outdoor applications.

III. The following display/control parameters shall be located on the front of the enclosure:

a. Hand/Off/Auto selector to start and stop the motor. In the auto position, the drive shall start/stop from a remote contact closure. In the auto position, motor speed shall be determined by the follower signal. In the manual position, motor speed shall be determined by manual adjustment.

b. Power on indication that the VFD is being supplied by the power line.

c. Fault indication that the VFD has tripped on a fault condition. Display shall indicate load parameters such as load percent, frequency or running load amps.

d. A set of form C, dry contacts to indicate when the VFD is in the run mode.

e. A set of form C, dry contacts to indicate when the VFD is in the fault mode.

f. Terminations for safety interlocks such as freeze and smoke shutdown.

g. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function shall provide up to 6 programmable restart attempts. The time delay before restart attempts shall be a minimum of 30 seconds. This function permits automatic restarting after the drive controller detects a fault, provided that the other operating functions are correct, a run command is present, and the fault has disappeared. This shall be a function that is field selectable.

h. The VFD shall include a door interlocked, padlockable, input power disconnect switch.

B. The following bypass features shall be included:

I. Manual bypass shall provide all the circuitry necessary to transfer the motor from the VFD to the power line, or from the line to the controller.

II. The AC Drive shall include mechanically and electrically interlocked isolation and bypass contactors complete with thermal overload relay, VFD/OFF/BYPASS switch and TEST/NORMAL selector switch.

III. Motor overload protection shall be provided in both the controller mode and the bypass mode.

IV. The operator shall have full control of the bypass starter by operation of the VFD/OFF/BYPASS selector switch.

V. In the automatic mode of operation the isolation and bypass contactors shall be sequenced by the 110 volt rated auto start contact provided by user.

VI. A test/normal selector switch shall provide test operation of the power

converter while operating the motor in bypass.

VII. A pilot light shall indicate whether motor is operating in drive or bypass mode.

C. Speed Reference Input:

I. Shall accept both a manual speed signal and a 0-10 VDC speed reference analog input signal from the Building Automation System (BAS). The input signal will generally be a temperature signal on single zone VAV applications or cooling tower control or a pressure signal on VAV applications.

D. Feedback Signal:

I. Provide 0-5 VDC or 0-20 mA analog output signal to indicate actual operating speed of VFD. Output signal shall be fed into the BAS.

E. The VFD shall include a standard EIA-485 communications port and capabilities to be connected to the following serial communications protocols at no additional cost and without the need to install any additional hardware or software in the VFD: BacNet MS/TP, Lonwork Free Topology (FTP) and Modbus.

2.3 Protective Features

A. The VFD shall include the following protective features:

I. Protection against input transient voltage spikes.

II. Separate overload protection for each motor controlled.

III. Protection against input power under voltage, over voltage, and phase loss.

IV. Protection against output current overload and over current.

V. Protection against over temperature within the VFD enclosure.

VI. Protection against over voltage on the DC bus.

VII. DC bus discharge circuit for protection of service personnel.

VIII. Insensitive to incoming power phase sequence.

IX. The number of restart attempts shall be adjustable from 0 to 20 and the time between attempts shall be adjustable between zero and 600 seconds. The original set-up shall be 4 restarts with 120 seconds between restarts.

X. Four programmable critical frequency lockouts ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment.

XI. An automatic start delay may be selected from 0 to 120 seconds. During the start delay the VFD shall be programmed to provide either no voltage to the motor or apply DC braking current if desired.

2.4 Adjustments

A. The VFD shall include the following adjustments inside the enclosure:

I. Maximum speed, adjustable 50-100% base speed.

II. Minimum speed, adjustable 0-50% base speed.

III. Acceleration time, adjustable 3 to 1800 seconds.

IV. Deceleration time, adjustable 3 to 1800 seconds with override circuit to prevent nuisance trips if decel time is set too short.

V. Current limit, adjustable 0-100%.

2.5 Servicae Conditions

A. The VFD shall be designed to operate within the following service conditions:

I. Ambient temperature, 14 to 113□F.

II. 0 to 95% relative humidity, non-condensing.

III. Elevation to 3,300 feet without derating.

IV. AC line voltage variation, -10% to +10% of nominal.

V. No side clearance shall be required for cooling.

VI. All VFD shall be plenum rated.

PART 3 - EXECUTION

3.1 Start Up Service

A. The manufacturer shall provide start up service by a factory trained service technician. The service technician shall verify correct installation, start up the drive, and check for proper operation.

B. The VFD's shall be mounted and installed in accordance with all local, state, federal and NEC codes.

C. Protection:
1. Before and during the installation, the VFD shall be protected from site and environmental contaminants.

D. Installation:
1. Installation shall be in compliance with the manufacturer’s instructions, drawings and recommendations.

E. Start-up Assistance:
1. On-site assistance shall be available from a factory certified technical representative who shall supervise the contractor’s installation, testing and start-up of the VFD.

F. Do not install VFD until building environment can be maintained in accordance with manufacturer’s instructions.

3.2 Training

A. The manufacturer shall have regularly scheduled maintenance and training schools on the equipment supplied.

B. Training course shall be quoted as a separate line item with submittal.

END OF SECTION

SECTION 23 2113

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Makeup-water piping.
4. Condensate-drain piping.
5. Blowdown-drain piping.
6. Air-vent piping.
7. Safety-valve-inlet and -outlet piping.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.2 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

B. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

C. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
1. Hot-Water Heating Piping: 100 psi at 200 deg F.
2. Chilled-Water Piping: 150 psi at 73 deg F.
3. Condenser-Water Piping: 150 psi at 73 deg F.
4. Makeup-Water Piping: See Plumbing Specifications.
5. Condensate-Drain Piping: See Plumbing Specifications.
6. Blowdown-Drain Piping: See Plumbing Specifications.
7. Air-Vent Piping: 200 deg F.
8. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.4 SUBMITTALS

A. Product Data: For each type of the following:
1. Pressure-seal fittings.
2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

3. Air control devices.
4. Chemical treatment.
5. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops. For plan views, use minimum scale of 1/8”=1’-0”.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
2. Fiberglass Pipe and Fitting Installers: Installers of RTRF and RTRP shall be certified by the manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.6 EXTRA MATERIALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. S. P. Fittings; a division of Star Pipe Products.

2. Grooved-End Copper Fittings: ASTM B 75 copper tube or ASTM B 584, bronze casting.
3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

E. Copper or Bronze Pressure-Seal Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Viega.

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

F. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.

b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
c. National Fittings, Inc.
d. S. P. Fittings; a division of Star Pipe Products.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

I. Steel Pressure-Seal Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Victaulic Company of America.

2. Housing: Steel.
3. O-Rings and Pipe Stop: EPDM.
4. Tools: Manufacturer's special tool.
5. Minimum 300-psig working-pressure rating at 230 deg F.

J. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inchmaximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. 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.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.

2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psigminimum working pressure where required to suit system pressures.

F. Dielectric Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Calpico, Inc.
    b. Lochinvar Corporation.

2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psigminimum working pressure at 225 deg F.

G. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Perfection Corporation; a subsidiary of American Meter Company.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Victaulic Company of America.

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psigminimum working pressure at 225 deg F.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Armstrong Pumps, Inc.
    b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    c. Flow Design Inc.
    d. Gerand Engineering Co.
    e. Griswold Controls.
    f. Taco.
2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Armstrong Pumps, Inc.
    b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    c. Flow Design Inc.
    d. Gerand Engineering Co.
    e. Griswold Controls.
    f. Taco.
    g. Tour & Andersson; available through Victaulic Company of America.
2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated, Pressure-Reducing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: Stainless Steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump; a division of ITT Industries.
d. Conbraco Industries, Inc.
e. Spence Engineering Company, Inc.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Stainless Steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flow Design Inc.
b. Griswold Controls.
c. Danfoxx

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg F.

2.6 AIR CONTROL DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.

3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

C. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

D. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

E. Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal.unit only; sized for compression-tank diameter. Provide tank fittings for 125-psigworking pressure and 250 deg F maximum operating temperature.
3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- 3” diameter gage glass, and slotted-metal glass guard.

F. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

G. Tangential-Type Air Separators:

1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg Fmaximum operating temperature.
2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for NPS 2and smaller; flanged connections for NPS 2-1/2and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

H. In-Line Air Separators:

1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to 175 psig.
3. Maximum Operating Temperature: Up to 300 deg F.

I. Air Purgers:

1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
2. Maximum Working Pressure: 150 psig.
3. Maximum Operating Temperature: 250 deg F.

2.7 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psigworking pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

2.8 HYDRONIC PIPING SPECIALTIES

A. 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 2and smaller; flanged ends for NPS 2-1/2and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2and smaller; flanged ends for NPS 2-1/2and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

F. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 1-1/2 and smaller, shall be any of the following:
1. Type L, hard drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

B. Hot-water heating piping, aboveground, NPS 2 and larger, shall be any of the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Chilled-water piping, aboveground, NPS 1-1/2 and smaller, shall be any of the following:
1. Type L, hard drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

D. Chilled-water piping, aboveground, NPS 2 and larger, shall be any of the following:
1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Makeup-water piping installed aboveground shall be either of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

F. Makeup-Water Piping Installed Belowground: Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

G. Condensate-Drain Piping: See Plumbing Specifications.

H. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

I. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

J. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such 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 Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 1 ball valve, and short NPS 1 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

N. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

O. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

R. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

S. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

T. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

U. Pre-insulated piping shall be provided for underground piping.

V. Victaulic or rolled groove type piping connectors are allowed only in the main mechanical equipment room. The use of Victaulic or rolled groove fitting is not allowed within the building.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 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. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.
10. NPS 10: Maximum span, 20 feet; minimum rod size, 3/4 inch.
11. NPS 12: Maximum span, 23 feet; minimum rod size, 7/8 inch.
12. NPS 14: Maximum span, 25 feet; minimum rod size, 1 inch.
13. NPS 16: Maximum span, 27 feet; minimum rod size, 1 inch.
14. NPS 18: Maximum span, 28 feet; minimum rod size, 1-1/4 inches.
15. NPS 20: Maximum span, 30 feet; minimum rod size, 1-1/4 inches.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

F. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

G. Support vertical runs at roof, at each floor, and at 10-footintervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

J. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

K. Pressure-Sealed Joints and Press Connections: copper and copper alloy press connections shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer. Cuts in copper tubing shall be made square to permit proper joining with the fittings with all edges deburred and cleaned of debris.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

G. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

H. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:
1. pH: 9.0 to 10.5.
2. "P" Alkalinity: 100 to 500 ppm.
3. Boron: 100 to 200 ppm.
4. Chemical Oxygen Demand: Maximum of 100 ppm. Revise this value if closed system contains glycol.
5. Corrosion Inhibitor:
   a. Sodium Nitrate: 1000 to 1500 ppm.
   b. Molybdate: 200 to 300 ppm.

c. Chromate: 200 to 300 ppm.
d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
e. Chromate Plus Molybdate: 50 to 100 ppm each.

6. Soluble Copper: Maximum of 0.20 ppm.
7. Tolyiriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum of 10 ppm.
8. Total Suspended Solids: Maximum of 10 ppm.
9. Ammonia: Maximum of 20 ppm.
10. Free Caustic Alkalinity: Maximum of 20 ppm.
11. Microbiological Limits:
    a. Total Aerobic Plate Count: Maximum of 1000 organisms/mL.
    b. Total Anaerobic Plate Count: Maximum of 100 organisms/mL.
    c. Nitrate Reducers: 100 organisms/mL.
    d. Sulfate Reducers: Maximum of zero organisms/mL.
    e. Iron Bacteria: Maximum of zero organisms/mL.

B. Install bypass chemical feeders in each hydronic system where indicated.
1. Install in upright position with top of funnel not more than 48 inches above the floor.
2. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections.
3. Install NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.

C. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

D. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION

SECTION 23 2123

HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. In-line circulators.
   2. Vertical in-line pumps.
   3. End-suction pumps.
   4. Automatic Condensate pump units

1.2 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.3 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

   1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on the specific types and models indicated. Subject to these specification requirements, other manufacturers' pumps with equal performance characteristics may be considered. Any additional cost required due to the contractors use of an alternate manufacturer shall be the contractor’s responsibility and there shall be no additional cost to the owner.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

E. Note: In all cases, base mounted pumps handling chilled water shall have an epoxy coating, minimum of 0.25” thick on base to prevent corrosion. Manufacturer shall warranty base for ten (10) years against corrosion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Mechanical Seals: One mechanical seal(s) for each pump.

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 following:

a. End-Suction Pumps:
1) Armstrong
2) Bell & Gossett
3) Weiman
4) Grundfos/PACO
5) Peerless

2.2 GENERAL PUMP REQUIREMENTS

A. A. Pump Units: Factory assembled and tested.

B. B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be non-overloading over full range of pump performance curve.

1. I. Minimum efficiency as indicated according to IEEE 112, Test Method B. Include motors with higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B.

2.3 IN-LINE CIRCULATORS

A. Description: Horizontal, in-line, centrifugal, single-stage, bronze-fitted, radially split case design; rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.
   1. Casing: Cast iron, with threaded companion flanges for piping connections, and threaded gage tappings at inlet and outlet connections.
      a. Connection Option: Unions at connections for casings that are not available with threaded companion flanges.
   2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.
   3. Impeller: ASTM B 36/B 36M, rolled-temper-brass fabrication, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.
   4. Shaft and Sleeve: Steel shaft with oil-lubricated copper sleeve.
   5. Seals: Mechanical type. Include carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
   6. Pump Bearings: Oil-lubricated, bronze journal and thrust type.
   7. Motor Bearings: Oil-lubricated, sleeve type.
   8. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
   9. Motor: Resiliently mounted to pump casing.

B. Capacities and Characteristics: See schedule.

2.4 COMPACT IN-LINE CIRCULATORS

A. Description: Water cooled, horizontal, in-line, compact design, seal-less, centrifugal, and single stage. Include pump and motor assembled on a common shaft in hermetically sealed unit, without stuffing boxes or mechanical seals. Include lubrication of sleeve bearing and cooling of motor by circulating pumped liquid through motor section, and isolation of motor section from motor-stator windings by corrosion-resistant, nonmagnetic, alloy liner. Include Design rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

B. Description: Cartridge type, horizontal, in-line, compact, seal-less, centrifugal, and single stage.
   1. Include pump and motor assembled on a common shaft in cartridge-type, hermetically sealed unit, without stuffing boxes or mechanical seals. Include isolation of motor section from motor- stator windings by corrosion-resistant, nonmagnetic, alloy liner. Include Design rated for 125- psig minimum working pressure and a continuous water temperature of 225 deg F.
   2. Casing: Cast bronze or cast iron, with stainless-steel liner, static O-ring seal to separate motor section from motor stator, and flanged piping connections.
   3. Impeller: Overhung, single suction, closed or open, nonmetallic.
   4. Shaft and Sleeve: Stainless-steel shaft with carbon-steel sleeve.
   5. Motor: Single speed.

C. Capacities and Characteristics: See schedule.

2.5 VERTICAL IN-LINE PUMPS

A. Description: Vertical, in-line, centrifugal, flexible-coupled, single-stage, radially split case design. Include vertical-mounting, bronze-fitted Design and mechanical seals rate for 125- psig minimum working pressure and a continuous water temperature of 225 deg F.
   1. Casing: Cast iron, with threaded companion flanges for piping connections smaller than NPS 3, drain plug at low point of volute, and threaded gage tappings at inlet and outlet connections.
   2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.

3. Wear Rings: Replaceable, bronze casing ring.
4. Shaft and Sleeve: Ground and polished stainless-steel shaft with bronze sleeve.
5. Shaft: Ground and polished stainless-steel shaft with axially split spacer coupling.
6. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
7. Seals: Stuffing box, with at least four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
8. Motor: Directly mounted to pump casing and with lifting and supporting lugs in top of motor enclosure.

B. Capacities and Characteristics: See schedule.

2.6 CLOSE-COUPLED, END-SUCTION PUMPS

A. Description: Centrifugal, close-coupled, end-suction, single-stage, bronze-fitted, back-pull-out, radially split case design; rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.
1. Casing: Cast iron, with flanged piping connections, drain plug at low point of volute, and threaded gage tappings at inlet and outlet connections.
a. Connection Option: Unions at connections for casings that are not available with threaded companion flanges.
2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, keyed to shaft, and secured by locking cap screw.
3. Wear Rings: Replaceable, bronze casing ring.
4. Shaft and Sleeve: Steel shaft extension with bronze sleeve and neoprene slinger.
5. Shaft: Stainless-steel shaft close coupled to motor shaft.
6. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
7. Motor: Directly mounted to pump casing and with supporting legs as integral Part of motor enclosure.

B. Capacities and Characteristics: See schedule.

2.7 FLEXIBLE-COUPLED, END-SUCTION PUMPS

A. Description: Base-mounted, centrifugal, flexible-coupled, end-suction, single-stage, bronze- fitted, back-pull-out, radially split case design; rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.
1. Casing: Cast iron, with flanged piping connections, drain plug at low point of volute, and threaded gage tappings at inlet and outlet connections.
2. Casing: Cast iron, with flanged piping connections, drain plug at low point of volute, threaded gage tappings at inlet and outlet connections, and integral feet or other means on volute to support weight of casing and attached piping. Casing shall allow removal and replacement of impeller without disconnecting piping.
3. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, keyed to shaft, and secured by locking cap screw.
4. Wear Rings: Replaceable, bronze casing ring.
5. Shaft and Sleeve: Steel shaft with bronze sleeve.
6. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
7. Seals: Stuffing box, with at least four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
8. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
9. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.

10. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment for motor sizes of 100 hp and smaller; with flange and sleeve section that can be disassembled and removed without removing pump or motor, for sizes larger than 100 hp.
11. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
12. Coupling Guard: Steel, removable, and attached to mounting frame.
13. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate for mounting pump casing, coupling guard, and motor. Field-drill motor-mounting holes for field-installed motors.
    a. Option: Cast-iron frames are acceptable.
14. Motor: Secured to mounting frame, with adjustable alignment.

B. Capacities and Characteristics: See schedule.

2.8 FLEXIBLE-COUPLED, DOUBLE-SUCTION PUMPS

A. Description: Base-mounted, centrifugal, flexible-coupled, double-suction, single-stage, bronze- fitted, axially split case design; rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F, with mechanical seals and impeller mounted between bearings.

B. Description: Base-mounted, centrifugal, flexible-coupled, double-suction, single-stage, bronze- fitted, axially split case design; rated for 175-psig minimum working pressure and a continuous water temperature of 250 deg F, with stuffing-box seals. Include impeller mounted between bearings and the following:
1. Casing: Cast iron; with ASME B16.1, Class 125 flanged pipe connections. Include threaded gage tappings at inlet and outlet connections, vent valve at high point of volute, and threaded drain plug at low point of volute.
2. Casing: Cast iron; with ASME B16.1, Class 250 flanged pipe connections. Include threaded gage tappings at inlet and outlet connections, vent valve at high point of volute, and threaded drain plug at low point of volute.
    a. Casing shall allow removal and replacement of impeller without disconnecting piping.
3. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, double suction, and keyed to shaft.
4. Wear Rings: Replaceable, bronze casing ring.
5. Shaft and Sleeve: Stainless-steel shaft with bronze sleeve.
6. Pump Shaft Bearings: Grease-lubricated ball bearings contained in cast-iron housing.
7. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
8. Seals: Stuffing box, with at least four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
9. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
10. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
11. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment for motor sizes of 100 hp and smaller; with flange and sleeve section that can be disassembled and removed without removing pump or motor, for sizes larger than 100 hp.
12. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
13. Coupling Guard: Steel, removable, and attached to mounting frame.
14. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate for mounting pump casing, coupling guard, and motor. Field-drill motor-mounting holes for field-installed motors.
    a. Option: Cast-iron frames are acceptable.
15. Motor: Secured to mounting frame, with adjustable alignment.

C. Capacities and Characteristics: See schedule.

2.9 VERTICAL-MOUNTING, FLEXIBLE-COUPLED, DOUBLE-SUCTION PUMPS

A. Description: Base-mounted, centrifugal, flexible-coupled, double-suction, single-stage, bronze- fitted, axially split case design; made for vertical mounting; and rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F, with mechanical seals.
   1. Casing: Cast iron; with ASME B16.1, Class 125 flanged pipe connections. Include threaded gage tappings at inlet and outlet connections and threaded drain plug at low point of volute.
   2. Casing: Cast iron; with ASME B16.1, Class 250 flanged pipe connections. Include threaded gage tappings at inlet and outlet connections and threaded drain plug at low point of volute.
   3. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, double suction, mounted between bearings, and keyed to shaft.
   4. Wear Rings: Replaceable, bronze casing ring.
   5. Shaft: Stainless-steel shaft with axially split spacer coupling.
   6. Pump Shaft Bearings: Grease-lubricated, ball-type, thrust bearings contained in cast- iron housing.
   7. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
   8. Seals: Stuffing box, with at least four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
   9. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
   10. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
   11. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment for motor sizes of 100 hp and smaller; with flange and sleeve section that can be disassembled and removed without removing pump or motor, for sizes larger than 100 HP
   12. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
   13. Baseplate: Steel or cast iron.
   14. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate for mounting pump casing, coupling guard, and motor. Field-drill motor-mounting holes for field-installed motors.
   15. Motor: Secured to mounting frame, with adjustable alignment.

B. Capacities and Characteristics: See schedule.

2.10 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle or straight pattern, 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory- or field-fabricated support.

B. Triple-Duty Valve: Angle or straight pattern, 175-psig pressure rating, cast-iron body, pump- discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features.

2.11 AUTOMATIC CONDENSATE PUMP UNITS

A. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch- minimum, electrical power cord with plug.

B. Capacities and Characteristics: See Plumbing Specifications and Schedules.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Division 23 Section "Common Work Results for HVAC."

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.

3.3 PUMP INSTALLATION

A. Comply Install pumps according to manufacturer's written instructions.
1. Install pumps according to ANSI Standards:
2. HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."
3. HI 2.1-2.5, "Vertical Pumps for Nomenclature, Definitions, Application and Operation."

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 continuous-thread hanger rods and elastomeric hangers of sufficient size to support pump weight. Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

E. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and elastomeric hangers of sufficient size to support pump weight. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment/Hangers and Supports for HVAC Piping and Equipment."

F. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

G. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.

3.4 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in ANSI Standards HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation, HI 2.1-2.5, " Vertical Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.5 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install check valve and throttling valve on discharge side of in-line circulators.

F. Install nonslam check valve and globe valve on discharge side of vertical in-line pumps.

G. Install suction diffuser and shutoff valve on suction side of vertical in-line pumps.

H. Install triple-duty valve on discharge side of vertical in-line pumps.

I. Install suction diffuser and shutoff valve on suction side of base-mounted pumps.

J. Install triple-duty valve on discharge side of base-mounted pumps.

K. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

L. Install pressure gages on pump suction and discharge. Install at integral pressure-gage tappings where provided.

M. Install temperature and pressure-gage connector plugs in suction and discharge piping around each pump.

N. Install check valve and gate or ball valve on each condensate pump unit discharge.

O. Install electrical connections for power, controls, and devices.

P. Electrical power and control wiring and connections are specified in Division 16 Sections.

Q. Ground equipment.
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 COMMISSIONING

A. Verify that pumps are installed and connected according to the Contract Documents.

B. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.

C. Perform the following preventive maintenance operations and checks before starting:
1. Lubricate bearings.
2. Remove grease-lubricated bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
3. Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
4. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag, until cause of trouble is determined and corrected.
5. Check suction piping connections for tightness to avoid drawing air into pumps.
6. Clean strainers.
7. Verify that pump controls are correct for required application.

D. Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:
1. Prime pumps by opening suction valves and closing drains, and prepare pumps for operation.
2. Open cooling water-supply valves in cooling water supply to bearings, where applicable.
3. Open cooling water-supply valves if stuffing boxes are water cooled.
4. Open sealing liquid-supply valves if pumps are so fitted.
5. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
6. Open circulating line valves if pumps should not be operated against dead shutoff.
7. Start motors.
8. Open discharge valves slowly.
9. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Let packing "run in" before reducing leakage through stuffing boxes; then tighten glands.
10. Check general mechanical operation of pumps and motors.
11. Close circulating line valves once there is sufficient flow through pumps to prevent overheating.

E. When pumps are to be started against closed check valves with discharge shutoff valves open, steps are the same, except open discharge valves before starting motors.

F. Refer to Division 23 for detailed requirements for testing, adjusting, and balancing hydronic systems.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:
1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."

3. Review data in maintenance manuals. Refer to Division 1.
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 23 3113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ducts and fittings.
2. Sheet metal materials.
3. Duct liner.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 DEFINITIONS

A. OSHPD: Office of Statewide Health Planning and Development (State of California).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For sealants, indicating VOC content.
4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, and vibration isolation.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans, drawn to scale, showing the items described in this Section, and coordinated with all building trades based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

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 shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

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 DUCTS AND FITTINGS

A. Single Wall Ductwork: Single wall, externally insulated, ductwork shall be provided only in interior spaces concealed from view.

B. Double Wall Ductwork: Double wall, interior insulated, ductwork shall be provided in all exterior locations and in all interior areas where ductwork is exposed to view.
   1. Dimensions: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.
   2. Color and Finish: Provide finish for exposed ductwork as directed by architect or owner.
   3. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
      a. Construct ducts of galvanized sheet steel unless otherwise indicated.
      b. For ducts exposed to weather, construct outer duct of Type 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.
   4. Inner Duct: Minimum 24-gauge solid galvanized sheet steel.
      a. In sound sensitive spaces such as auditoriums, libraries, band/music classrooms, etc or other areas where duct lining is recommended for sound attenuation, inner duct shall be perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
   5. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
      a. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
      b. Furnish insulation with antimicrobial protection.
      c. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

C. 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 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.

D. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," and 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. For rectangular ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For rectangular 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. For Transverse Joints in Round Ducts Larger Than 60 Inches in Diameter: Flanged

E. 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," and 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. All rectangular duct longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application
2. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
3. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

F. Rectangular Duct 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."

G. Round Duct 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."

H. 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) of the inner duct.

2.3 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: G90.
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: Black.
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.

2.4 DUCT LINER

A. Duct lining (internal insulation) shall be provided for the entire length of both the supply and return ductwork for the following:
1. In sound sensitive spaces within the facility such as auditoriums, libraries, band/music classrooms, etc or other areas where duct lining is recommended for sound attenuation.
2. In all occupied areas where ductwork is exposed to view.

B. Duct lining (internal insulation) shall additionally be installed on the supply and return ductwork for the following areas:
1. The first (10) feet of the supply and return duct from roof mounted equipment through the roof for sound mitigation.
2. The first (25) feet of the supply and return duct from air handling units interior to the building for sound mitigation.
3. In mechanical rooms or similar areas where exposed insulation below 8’-0” AFF may be subject to incidental damage.

C. 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 with integral anti-microbial agent.

1. Available Manufacturers:
   a. Armstrong World Industries, Inc.
   b. Armacell
   c. K-Flex
   d. Aeroflex
   e. Johns-Mansville
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."
4. Anti-microbial agent: Integral EPA-registered anti-microbial agent free of CFC’s, HFC’s, HCFC’s, PBDE’s formaldehyde and fibers.

D. Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Follow manufacturer’s instructions first as that has precedence over this specification.
2. 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.
3. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
4. Butt transverse joints without gaps, and coat joint with adhesive.
5. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
6. 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.
7. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpmor greater.
8. 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.
9. 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.

10. 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.

11. 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.

2.5 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. Sealant: Modified styrene acrylic.
3. Water resistant.
4. Mold and mildew resistant.
5. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
6. Service: Indoor and outdoor.
7. Service Temperature: Minus 40 to plus 200 deg F.
8. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum.
9. Sealant shall have a VOC content of 420 g/L or less.
10. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Sealant shall have a VOC content of 420 g/L or less.
9. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 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. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached. Obtain written permission from Architect or Owner before fastening to concrete structural members.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

I. 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.

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 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

1. Provide ductwork openings with access panels appropriate for accessing and maintaining fire, combination fire/smoke, and smoke dampers. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.

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 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.

3.4 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.

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.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 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 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Paint or apply appropriate finish the the outside wall of any ductwork exposed to view as directed by architect or owner.

3.7 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. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (both positive and negative pressures).
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.

3.8 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve the minimum SMACNA pressure class, seal class, and leakage class as indicated below or 1” greater than the static pressure rating of the scheduled equipment (whichever is greater).
2. Underground Ducts: Concrete-encased, galvanized sheet steel.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    a. Pressure Class: Positive 2-inch wg.

2. Ducts Connected to Constant-Volume Air-Handling Units:

   a. Pressure Class: Positive 3-inch wg.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

   a. Pressure Class: Positive 4-inch wg.

4. Ducts Connected to Equipment Not Listed Above:

   a. Pressure Class: Positive 2-inch wg.

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.

2. Ducts Connected to Air-Handling Units:

   a. Pressure Class: Positive or negative 4-inch wg.

3. Ducts Connected to Equipment Not Listed above:

   a. Pressure Class: Positive or negative 2-inch wg.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

   a. Pressure Class: Negative 3-inch wg.

2. Ducts Connected to Air-Handling Units:

   a. Pressure Class: Positive or negative 4-inch wg.

3. 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: 8.
   d. SMACNA Leakage Class for Round and Flat Oval: 8.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Pressure Class: Positive or negative 2-inch wg.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts:
   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Galvanized.
3. Stainless-Steel Ducts:
   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Galvanized.
4. Aluminum Ducts: Aluminum.

G. Liner:
   1. Supply-Air Ducts and Supply Fan Plenums: Flexible elastomeric, 2 inches thick.
   2. Return-Air Ducts, Return-Fan Plenums, and Transfer Ducts: Flexible elastomeric, 1-1/2 inches thick.

H. Double-Wall Duct Interstitial Insulation:
   1. Supply-Air Ducts: 2 inches thick.
   2. Return-Air Ducts: 1-1/2 inches thick.

I. Elbow Configuration:

   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

      a. Velocity 1000 fpm or Lower:

         1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
         2) Mitered Type RE 4 without vanes.

      b. Velocity 1000 to 1500 fpm:

         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

      c. Velocity 1500 fpm or Higher:

         1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

      a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

      a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

         1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
         2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
         3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
         4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12-Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14-Inches and Larger in Diameter: Standing seam or Welded.

J. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Conical spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers
4. Fire dampers.
5. Smoke dampers
6. Combination fire and smoke dampers
7. Turning vanes.
8. Duct-mounting access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for electric and pneumatic damper actuators.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounting fire and smoke detectors.

1.2 SUBMITTALS

A. Product Data: For the following:
1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers
4. Fire dampers.
5. Smoke dampers
6. Combination fire and smoke dampers
7. Turning vanes.
8. Duct-mounting access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.
4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

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 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. 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.

2.3 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. CESCO Products.
4. Duro Dyne Corp.
5. Greenheck.
6. Penn Ventilation Company, Inc.
7. Prefco Products, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.

B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Low-Leakage Gravity Dampers: Gravity dampers shall have an air leakage rate of less than or equal to the following values as determined at 1.0-inch water gauge when tested in accordance with AMCA 500D. Dampers shall be labeled by and approved agency.
1. For dampers greater than or equal to 24-inches in either direction: 20 cfm/ft²
2. For dampers less than 24-inches in either direction: 40 cfm/ft²

D. Frame: 0.052-inch thick galvanized sheet steel, with welded corners and mounting flange.

E. Blades: 0.025-inch thick, roll-formed aluminum.

F. Blade Seals: Neoprene.

G. Blade Axles: Galvanized Steel.

H. Tie Bars and Brackets: Galvanized Steel.

I. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Available Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Flexmaster U.S.A., Inc.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch-thick, galvanized sheet steel.
3. Aluminum Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
6. Blade Axles: Galvanized steel.
7. Bearings: Oil-impregnated bronze.
8. Tie Bars and Brackets: Aluminum.
9. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch-thick, galvanized sheet steel.
3. Aluminum Frames: Hat-shaped, 0.125-inch-thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.125-inch-thick extruded aluminum.
6. Blade Axles: Galvanized steel.
7. Bearings: Oil-impregnated bronze or Molded synthetic or Stainless-steel sleeve thrust or ball.
8. Blade Seals: Vinyl or Neoprene.
9. Jamb Seals: Cambered aluminum.
10. Tie Bars and Brackets: Galvanized steel.

E. Jackshaft: 1-inch-diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: 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. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 MOTORIZED CONTROL DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. CESCO Products.
4. Duro Dyne Corp.
5. Greenheck.
6. McGill AirFlow Corporation.
7. METALAIRE, Inc.
8. Nailor Industries Inc.
9. Penn Ventilation Company, Inc.
10. Ruskin Company.
11. Vent Products Company, Inc.

B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch thick, galvanized-steel damper blades with maximum blade width of 8 inches.

1. Secure blades to 1/2-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Provide opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 4 cfm per sq. ft. of damper area, at differential pressure of 1.0-inch wg when tested according to AMCA 500D.

2.6 FIRE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. CESCO Products.
3. Greenheck.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Prefco Products, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.
11. Ward Industries, Inc.

B. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 2 hours.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 165 deg F rated.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.

2. CESCO Products.
3. Greenheck.
4. Nailor Industries Inc.
5. Penn Ventilation Company, Inc.
6. Ruskin Company.

B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

C. Fusible Links: Replaceable, 165 deg F rated.

D. Frame and Blades: 0.064-inch thick, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, 0.052-inch thick, galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Modulating and two-position action.

1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf .
4. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
6. Electrical Connection: 115 V, single phase, 60 Hz.

2.8 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch-wide, single-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.
d. Ward Industries, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.9 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches. Provide air tight gasketing all around door opening.

1. Manufacturers:

a. American Warming and Ventilating.
b. CESCO Products.
c. Ductmate Industries, Inc.
d. Flexmaster U.S.A., Inc.
e. Greenheck.
f. McGill AirFlow Corporation.
g. Nailor Industries Inc.
h. Ventfabrics, Inc.
i. Ward Industries, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

a. Less Than 12 Inches Square: Secure with two sash locks.
b. Up to 18 Inches Square: Two hinges and two sash locks.
c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Available Manufacturers:

a. Ductmate Industries, Inc.
b. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Pressure Relief Access Door: Double wall and duct mounting; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.

1. Available Manufacturers:

a. American Warming and Ventilating.
b. CESCO Products.
c. Ductmate Industries, Inc.
d. Greenheck.
e. KEES, Inc.
f. McGill AirFlow Corporation.
g. Nexus PDQ.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

F. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.10 FLEXIBLE CONNECTORS

A. Available Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip approximately 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch thick, galvanized sheet steel. Select metal compatible with ducts.

D. 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.

2.11 FLEXIBLE DUCTS

A. Available Manufacturers:

1. Flexmaster U.S.A., Inc.
2. Hart & Cooley, Inc.
3. McGill AirFlow Corporation.
4. Thermaflex

B. Insulated-Duct Connectors: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F
4. Minimum R-value = 6.0

C. Flexible Duct Clamps: Nylon strap, in sizes 3 through 18 inches to suit duct size.

2.12 DUCT ACCESSORY HARDWARE

A. 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.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories 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. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

D. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

E. Provide test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

G. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.

H. Install the following sizes for duct-mounting, rectangular access doors:

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.

I. Install the following sizes for duct-mounting, pressure relief access doors:

1. One-Hand or Inspection Access: 7 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 13 inches in diameter.
4. Head and Shoulders Access: 19 inches in diameter.

J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment."

K. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

L. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to low pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

P. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION

SECTION 23 3423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.
2. Ceiling-mounting ventilators.
3. In-line centrifugal fans.

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. 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.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: two set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan Company
3. American Coolair Corp.

4. Ammerman; General Resource Corp.
5. Breidert Air Products.
6. Broan Mfg. Co., Inc.
7. Carnes Company HVAC.
8. Central Blower Co.
9. Dayton Electric Manufacturing Co.; a division of W. W. Grainger, Inc.
10. Delhi Industries Inc.
11. Greenheck.
12. Hartzell Fan, Inc.
13. JencoFan; Div. of Breidert Air Products.
14. Loren Cook Company.
15. NuTone Inc.
16. Penn Ventilation.
17. Quietaire Corporation.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
1. Configuration: Self-flashing without a cant strip, with mounting flange, Built-in cant and mounting flange, or Built-in raised cant and mounting flange, depending upon the type of roof and roof insulation. Vendor to select configuration based on roof type.
2. Overall Height: 14 inches.
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Mounting Pedestal: Galvanized steel with removable access panel.
7. Vented Curb: Unlined with louvered vents in vertical sides.

H. Capacities and Characteristics: See schedule.

2.2 CEILING-MOUNTING VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Coolair Corp.
2. Ammerman; General Resource Corp.
3. Breidert Air Products.
4. Broan Mfg. Co., Inc.
5. Carnes Company HVAC.
6. Dayton Electric Manufacturing Co.; a division of W. W. Grainger, Inc.
7. Greenheck.
8. JencoFan; Div. of Breidert Air Products.
9. Loren Cook Company.
10. Penn Ventilation.

B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

1. Variable-Speed 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.

H. Capacities and Characteristics: See schedule.

2.3 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corp.
2. American Coolair Corp.
3. Ammerman; General Resource Corp.
4. Bayley Fans; a division of Lau Industries, Inc.
5. Breidert Air Products.
6. Carnes Company HVAC.
7. Greenheck.
8. Hartzell Fan, Inc.
9. JencoFan; Div. of Breidert Air Products.
10. Loren Cook Company.
11. Madison Manufacturing.
12. Penn Ventilation.
13. Quietaire Corporation.

B. Description: In-line, direct or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven 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, enclosure 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. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. 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.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

H. Capacities and Characteristics: See schedule.

2.4 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.5 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using elastomeric mounts having a static deflection of 1 inch.

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by code. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

E. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

F. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

G. Support suspended units from structure using threaded steel rods and elastomeric hangers.

H. Install units with clearances for service and maintenance.

I. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

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. Perform the following field tests and inspections and prepare test reports:

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 cleaning and adjusting are complete.
4. 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.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "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.

END OF SECTION

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SECTION 23 3600

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Shutoff single-duct air terminal units.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

   1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
   2. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For air terminal 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. Instructions for resetting minimum and maximum air volumes.
   2. Instructions for adjusting software set points.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

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. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.4 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. Environmental Technologies, Inc.; Enviro-Air Div.
   b. Nailor Industries of Texas Inc.
   c. Titus.
   d. Trane Co. (The); Worldwide Applied Systems Group.
   e. Metal Industries
   f. Price

2.2 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.

B. Casing: 0.034-inch steel or 0.032-inch aluminum.
   1. Casing Lining: Adhesive attached, 3/4-inch-thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
   2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
   3. Air Outlet: S-slip and drive connections, size matching inlet size.
   4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.

C. Regulator Assembly: Extruded-aluminum or galvanized-steel components; key damper blades onto shaft with nylon-fitted pivot points located inside unit casing.

   1. Automatic Flow-Control Assembly: Combined spring rates shall be matched for each volume-regulator size with machined dashpot for stable operation.
   2. Factory-calibrated and field-adjustable assembly with shaft extension for connection to externally mounted control actuator.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
   1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
   2. Damper Position: Normally open.

E. Attenuator Section: 0.034-inch steel or 0.032-inch aluminum sheet metal.
   1. Lining: Adhesive attached, 3/4-inch- thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

F. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.

G. Electric Heating Coil: Slip-in-type, open-coil design with integral control box factory wired and installed. Include the following features:

   1. Primary and secondary overtemperature protection.
   2. Nickel chrome 80/20 heating elements.
   3. Airflow switch.
   4. Noninterlocking disconnect switch.
   5. Fuses (for coils more than 48 A).

6. Mercury contactors.
7. Pneumatic-electric switches and relays.
8. Magnetic contactor for each step of control (for three-phase coils).

H. Electric Controls: Damper actuator and thermostat.
1. Damper Actuator: 24 V, powered closed, spring return open.
2. Thermostat: Wall-mounting electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.

I. Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat with integral airflow transducer and room sensor shall be compatible with temperature controls specified in other Division 23 Sections and shall have the following features:
1. Damper Actuator: 24 V, powered closed, spring return open.
2. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 6-inch wg; and shall have a multipoint velocity sensor at air inlet.
3. Thermostat: Wall-mounting electronic type with the following features:

a. Proportional, plus integral control of room temperature.
b. Time-proportional reheat-coil control.
c. Temperature set-point display in Fahrenheit and Celsius.

J. Factory-Mounted and -Wired Controls: The terminal unit manufacturer shall provide the following components for each cooling only VAV terminal unit for interface and mounting of the UC (Unitary Controller):
1. Primary air dampers to be controlled by the UC.
2. Enclosure to house the UC and associated components or suitable mounting brackets within the terminal unit enclosure.
3. Multi-point averaging type flow sensor at the primary air inlet to the terminal unit.
a. The FMCS subcontractor shall furnish to the terminal unit manufacturer the unitary controller and damper actuator. The FMCS subcontractor shall field install the room temperature sensor and discharge air temperature sensor.

K. DDC Controls: DDC Controls shall be furnished by the FMCS Contractor and installed at the terminal unit factory. Single-package unitary controller and actuator specified in Division 23 Section "Instrumentation and Control for HVAC."

L. DDC Controls: Bidirectional damper operators and microprocessor-based controller and room sensor shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:
1. Damper Actuator: 24 V, powered closed, spring return open.
2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:

a. Proportional, plus integral control of room temperature.
b. Time-proportional reheat-coil control.
c. Occupied and unoccupied operating mode.
d. Remote reset of airflow or temperature set points.
e. Adjusting and monitoring with portable terminal.
f. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."

3. Room Sensor: Wall mounting, with temperature set-point adjustment and access for connection of portable operator terminal.

M. Control Sequence:

1. Suitable for operation with duct pressures between 0.25- and 6.0-inch wg inlet static pressure.
2. Factory-mounted and -piped, 5-micron filter; velocity-resetting, adjustable, high-limit control; and amplifying relay.
3. System-powered, wall-mounting thermostat.

2.3 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air terminal units to allow service and maintenance.

C. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

E. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

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.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions and do the following:

a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
b. Verify that controls and control enclosure are accessible.
c. Verify that control connections are complete.
d. Verify that nameplate and identification tag are visible.
e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

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SECTION 23 3713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:
1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

C. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

D. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

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 GRILLES AND REGISTERS

A. Fixed Face Grille or Register:

1. Manufacturers:
   a. Krueger.
   b. Nailor Industries of Texas Inc.
   c. Price Industries.
   d. Titus.
   e. Tuttle & Bailey.

2. Features and accessories: See schedule.

2.3 LINEAR SLOT OUTLETS

A. Linear Bar Grille or Diffuser

1. Manufacturers:
   a. Krueger.
   b. Nailor Industries of Texas Inc.
   c. Price Industries.
   d. Titus.
   e. Tuttle & Bailey.

2. Features and accessories: See schedule.

2.4 CEILING DIFFUSER OUTLETS

A. Square Ceiling Diffusers:

1. Manufacturers:
   a. Krueger.
   b. METALAIRE, Inc.; Metal Industries Inc.
   c. Nailor Industries of Texas Inc.
   d. Price Industries.
   e. Titus.
   f. Tuttle & Bailey.

2. Features and accessories: See schedule.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles 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 practicable. 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, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

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SECTION 23 8126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

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. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Units shall be designed to operate with HCFC-free refrigerants.

1.4 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 07 Section "Roof Accessories."

1.5 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. Coordinate warranty with Owner.
1. Warranty Period: Five years from date of Owner Acceptance.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Two sets of filters for each unit.
2. Fan Belts: Two sets of belts for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Air Conditioning; Div. of Carrier Corporation.
2. Friedrich Air Conditioning Company.
3. Koldwave, Inc.
4. Lennox Industries Inc.
5. Mitsubishi Electric Sales Canada, Inc.
6. Mitsubishi Electronics America, Inc.; HVAC Division.
7. Mitsubishi Heavy Industries America, Inc.; Air-Conditioning & Refrigeration Division, Inc.
8. Sanyo Fisher (U.S.A.) Corp..
9. Trane Company (The); Unitary Products Group.
10. York International Corp.

2.2 WALL-MOUNTING, FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. 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.

D. Fan: Direct drive, centrifugal fan.

E. Filters: Permanent, cleanable.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. 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.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
1. Compressor Type: Scroll.
2. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
3. Refrigerant Charge: R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 20 deg F.

H. Mounting Base: Polyethylene.

2.4 ACCESSORIES (See schedule)

A. Control equipment and sequence of operation are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection, including auto setting.

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. 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.

F. Additional Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable frequency drive operation.
3. Monitor cooling load.
4. Monitor air distribution static pressure and ventilation air volumes.

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. Install ground-mounting, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install ground-mounting, compressor-condenser components on polyethylene mounting base.

E. Install roof-mounting compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

F. Install seismic restraints.

G. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. 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 Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. 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. 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.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

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SECTION 23 8416

INDOOR, MECHANICAL DEHUMIDIFICATION UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged, factory-assembled and -tested, refrigerant-type, indoor, mechanical dehumidification units designed for indoor installation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of indoor, mechanical dehumidification unit.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each indoor, mechanical dehumidification unit.

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. Detail fabrication and assembly of dehumidification units.
4. 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.
5. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For indoor, mechanical dehumidification units.

1. 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.
2. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates for indoor, mechanical dehumidification units, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Test Reports: For each indoor, mechanical dehumidification unit, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dehumidification units to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of indoor, mechanical dehumidification units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than one years from date of Substantial Completion.
2. Warranty Period for Refrigerant Coils: Manufacturer's standard, but not less than one years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR, MECHANICAL DEHUMIDIFICATION UNIT MANUFACTURERS

A. Manufacturers:
1. Desert Aire
2. Dectron

2.2 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. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

C. ASHRAE 62.1 Compliance: Section 5, "Systems and Equipment" and Section 7, "Construction and System Start-up."

D. ASHRAE 15 Compliance: "Safety Standard for Refrigeration Systems."

E. Capacities and Characteristics: See Schedule.

2.3 CASINGS

A. Casing: Double-wall construction with interior corrosion-resistant coating and exterior powder-coated steel or aluminum, stainless-steel fasteners, knockouts for electrical and piping connections, condensate drain connection, and lifting lugs. Joints sealed for airtight enclosure.

1. Access: Hinged access doors with neoprene compression gaskets and cam latches.
2. Insulation: Minimum 2-inch thick, glass-fiber-insulation fill or closed cell foam, with thermal breaks.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Drain Pan and Connection: Stainless steel; insulated and complying with ASHRAE 62.1.

2.4 FANS

A. Supply Fans:

1. Blades: Backward inclined.
2. Type: Housed, centrifugal.
3. Blade and Housing Material: Galvanized steel with powder-coated finish.
4. Drive: Direct-driven with keyed motor shaft.

B. Fan Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.

C. Variable-Frequency Motor Controller: Comply with Section 262923 "Variable-Frequency Motor Controllers."

D. Variable-Frequency Motor Controller:

1. Manufactured Units: Pulse-width modulated; variable torque for Design A and Design B motors.
2. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage ranges; maximum voltage equals input voltage.
3. Unit Operating Requirements:

a. Internal Adjustability:

1) Minimum Speed: 5 to 25 percent of maximum rpm.
2) Maximum Speed: 80 to 100 percent of maximum rpm.
3) Acceleration: 0.1 to 999.9 seconds.
4) Deceleration: 0.1 to 999.9 seconds.
5) Current Limit: 30 to minimum of 150 percent of maximum rating.

b. Self-Protection and Reliability Features:

1) Surge suppression.
2) Loss of input signal protection.
3) Under- and overvoltage trips.
4) Variable-frequency controller and motor-overload/overtemperature protection.
5) Critical frequency rejection.
6) Loss-of-phase protection.
7) Reverse-phase protection.
8) Motor-overtemperature fault.

c. Bidirectional autospeed search.

d. Torque boost.
e. Motor temperature compensation at slow speeds.

1) Panel-mounted operator station.
2) Historical logging information and displays.
3) Digital indicating devices.

f. Control Signal Interfaces: Electric.
g. Proportional-integral-derivative control interface.
h. DDC system for HVAC Protocols for Network Communications: ASHRAE 135.

4. Line Conditioning:

a. Input line conditioning.
b. Output filtering.
c. EMI/RFI filtering.

5. Bypass Systems:

a. Bypass Mode: Field-selectable automatic or manual.
b. Bypass Controller: Two-contactor style, with bypass and output isolating contactors and isolating switch.
c. Bypass Contactor Configuration: Full-voltage (across the line) type.

2.5 FILTERS

A. Pleated:

1. Thickness: 2 inches.
2. MERV Rating: MERV 11, according to ASHRAE 52.2.

2.6 REFRIGERATION SYSTEM

A. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IES 90.1.

B. Heat Rejection: The unit shall be designed to maintain optimum comfort levels and shall not allow wide swings in pool water or room air conditions. The unit shall be able to simultaneously provide air conditioning and reject heat to pool water, reject heat to the air (Hot gas reheat), or reject heat to ambient air (condenser). Unit shall communicated with separate pool heater by others so as to not overheat pool.

C. Refrigerant Coils with Multiple Refrigerant Circuits:

1. Tubes: Copper.
2. Fins:

a. Material: Aluminum.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Stainless-steel frame.
6. Coatings: Corrosion-resistant coating.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
8. Source Quality Control: Factory test to minimum 450-psig internal pressure and to minimum 300-psig internal pressure while underwater.

D. Compressors: Hermetic, scroll compressors with integral vibration isolators and crankcase heaters that de-energize during compressor operation; with thermal-expansion valves, filter-dryers, sight glasses, compressor service valves, and liquid- and suction-line service valves.

1. Minimum Number of Refrigerant Circuits: Two for compressor capacities of more than 7-1/2 tons.
2. Refrigerant: R-410A.
3. Capacity Control:

    a. Hot-gas bypass valve and piping on one compressor.
    b. Cycle compressor.

4. Low-Pressure Cutout: Manual reset after three automatic-reset failures.
5. High-Pressure Cutout: Manual reset.
6. Compressor Motor Overload Protection: Manual reset.
7. Antirecycling Timing Device: Prevent compressor restart for five minutes after shutdown.
8. Defrost Cycle: Adjustable timer shuts off supply fan. Compressor cycles until suction-line temperature confirms thawed evaporator coil.

E. Energy Recovery Heat Exchanger (Pool Heater): Cupronickel, coaxial, vented, double-wall construction for potable-water service.

2.7 REMOTE-MOUNTED, AIR-COOLED CONDENSER UNIT

A. Casing: Steel, baked-enamel finish; with access doors or 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.

B. Refrigerant Coil:

1. Copper tube with mechanically bonded aluminum fins; with liquid subcooler.
2. Coating: corrosion-resistant coating.

C. Fan: Aluminum-propeller type, directly connected to permanently lubricated motor with integral thermal-overload protection.

D. Adjustable, Low Ambient Head-Pressure Control: Designed to operate at temperatures as low as 0 deg F by cycling condenser fans and controlling speed of last fan of each circuit.

E. Mounting Base: Same material as unit base.

2.8 HEATING COILS

A. Hot-Water Coil: Continuous circuit coil.

1. Tubes: Copper.
2. Fins:

    a. Material: Aluminum.
    b. Fin Spacing: Maximum 10 fins per inch.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Cast iron with drain and air vent tappings.
5. Frames: Galvanized-steel channel, minimum 0.052 inch.
6. Coatings: Corrosion-resistant coating.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

a. Working-Pressure Ratings: Minimum 200 psig, 325 deg F.

8. Source Quality Control: Test to minimum 300 psig internal pressure.

2.9 DAMPERS

A. Outdoor-, Return-, and Exhaust-Air Dampers: Opposed-blade, aluminum dampers with zinc-plated-steel operating rod rotating in sintered bronze or nylon bearings. Provide blade gaskets and edge seals, and mechanically fasten blades to operating rod. Size outdoor air damper for the greater of: [0 to 25 percent outdoor air] and [percentage described on equipment schedule], with motorized operator and filter.

B. Face-and-Bypass Dampers: Opposed-blade, aluminum dampers with zinc-plated-steel operating rods rotating in sintered bronze or nylon bearings with operating rods connected with a common linkage. Provide blade gaskets and edge seals, and mechanically fasten blades to operating rod.

C. Outdoor-, Return-, and Exhaust-Air Dampers:

1. Low-leakage, double-skin, airfoil-blade, aluminum dampers.
2. Compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement.
3. Zinc-plated-steel operating rods rotating in stainless-steel sleeve bearings mounted in a single aluminum frame.
4. Operating rods connected with a common linkage.
5. Leakage rate shall not exceed 5 cfm/sq. ft. at 1-inch wg and 9 cfm/sq. ft at 4-inch wg.

D. Damper Operator: 24 V ac, close coupled, with gear train sealed in oil and with spring return.

2.10 CONTROLS

A. Comply with requirements in Section 230923 "Direct Digital Control (DDC) System for HVAC" for control equipment and in Section 230993.11 "Sequence of Operations for HVAC DDC."

B. Control Panel: Integral service compartment containing fan-motor thermal and overload cutouts, compressor thermal and overload cutouts, 115-V control transformer if required, magnetic contactors for fan and compressor motors, and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.

C. Interface with DDC System for HVAC: Factory-installed hardware and software to enable the DDC system for HVAC to monitor, control, and display status and alarms.

D. Operating Control: Space humidistat cycles the compressor. Humidistat shall incorporate fan on-off-auto switch.

E. Operating Control: Factory-installed microprocessor controller, capable of being remotely mounted.

1. Display the following on the face of controller:

a. System on.
b. System dehumidifying mode.
c. System air-conditioning mode.
d. System outdoor-air (economizer) mode.
e. System heating pool water.
f. Auxiliary space heat is operating.
g. Unit requires service.
h. Return-air (space) temperature.
i. Return-air (space) humidity.
j. Pool-water temperature.

k. Outdoor-air temperature.

2. Indicate the following sensor failures on panel:

a. Airflow: Dirty air filter, blocked airflow, and fan failure.
b. Refrigerant high and low pressure.
c. High water temperature.
d. High and low evaporator temperature.
e. Low water flow.
f. Communication fault.
g. System off.
h. Antishort cycle delay.
i. Power failure.

3. Provide access to the following set points on panel:

a. Space temperature.
b. Space relative humidity.
c. Outdoor ventilation/air-conditioning changeover temperature.
d. Airflow alarm.

4. Provide the following displays on panel:

a. Space temperature.
b. Space relative humidity.
c. Outdoor-air temperature.
d. Supply-air temperature.
e. Return-air temperature.
f. Airflow rating.
g. Air-off evaporator temperature.
h. Return-air relative humidity.
i. Service codes.

5. Provide the following controls on panel:

a. System on-off, fan continues to run.
b. Fan on-off.
c. Service code access.
d. System dehumidifying mode.
e. System air-conditioning mode.
f. System outdoor-air (economizer) mode.
g. Auxiliary space heat is operating.
h. Outdoor-air-temperature, conditioned-space-temperature, and control set-point-temperature digital display.
i. Outdoor enthalpy digital display.
j. Filter pressure drop digital display.
k. Status: Airflow, fans, system, unit operation, and operating mode.
l. Alarm digital display.

F. Operating Control: Factory-installed microprocessor controller.

1. Factory-installed operator panel with backlit display, capable of being remotely mounted, allows menu-driven display for navigation and control of unit.
2. Integral clock.
3. Personal computer interface.
4. Integral LAN for direct connection to BACnet.
5. Factory programmed.
6. Unit-Mounted Sensors:

a. Airflow switch.
b. Compressor-discharge temperature.
c. Evaporator-air temperature.
d. Pool-water-out temperature.
e. Pool-water-in temperature.
f. Relative humidity.
g. Return-air temperature.
h. Supply-air temperature.

7. Integral diagnostics.
8. Nonvolatile memory.
9. IP or SI display.
10. Provide the following status and alarm functions:

a. System: On-off.
b. Power failure.
c. Fan: Off, overload.
d. Compressor: On, turned off, overload, high pressure, low pressure, overheat, oil failure, and pumpdown.
e. Evaporator damper closed.
f. Pool: Low water flow, heating on.
g. Dehumidification: Call for, on.
h. Air Conditioning: Call for, on.
i. System outdoor-air (economizer) mode.
j. Auxiliary space heat on.
k. Alarms: Firestat, freezestat, and filters.

11. Provide the following controls via operator panel:

a. Compressor auto-off.
b. Fan auto-off.
c. Set-Point Adjustments: Relative humidity, temperatures, deadbands, and differentials.
d. Sensor calibration.

2.11 ACCESSORIES

A. Water-Cooling Heat Exchanger: Coaxial, vented, double-wall construction; with three-way refrigerant control valve.

B. Smoke Detectors: Photoelectric detector located in return-air plenum, to de-energize unit.

1. Operating Voltage: 24 V dc, nominal.
2. Self-Restoring: Detectors do not require resetting or readjusting after actuation to restore them to normal operation.
3. Plug-in Arrangement: Detector and associated electronic components mounted in module with tamper-resistant connection to fixed base with twist-locking plug. Terminals in fixed base accept building wiring.
4. Integral Visual-Indicating Light: Digital-display type indicating detector operation.
5. Sensitivity can be tested and adjusted in-place after installation.
6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the fire-alarm control panel.
7. Sensor: Digital display or infrared light source with matching silicon-cell receiver.
8. Detector Sensitivity: Between 2.5 and 3.5 percent/foot of smoke obscuration when tested according to UL 268A.
9. Integral Thermal Detector: Fixed-temperature type with 135 deg F setting.

C. Electrical Convenience Outlet: 115 V ac fused, duplex, straight-blade receptacles, separately fused and located inside control panel.

2.12 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 A240/240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.

F. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 3,000-hour salt-spray test according to ASTM B117.

1. Standards:

a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of 100 in/lb.
c. ASTM B3359 for cross hatch adhesion of 5B.

2. Application: Immersion.
3. Thickness: 1 mil.
4. Gloss: Minimum gloss of 60 on a 60-degree meter.

2.13 SOURCE QUALITY CONTROL

A. Verification of Performance: Factory test and rate dehumidification units according to AHRI 910.

B. Sound-Power-Level Ratings: Factory test and rate dehumidification units according to AHRI 575.

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. Examine roughing-in for hot-water and refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where dehumidification units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting:

1. Install dehumidification units on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-In-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

3.3 PIPING CONNECTIONS

A. Where piping is installed adjacent to dehumidification units, allow space for service and maintenance of dehumidification units.

B. Connect piping to dehumidification units mounted on vibration isolators with flexible connectors.

C. Connect condensate drain pans using minimum NPS 1-1/4 copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan, and install cleanout at changes in direction.

D. Refrigerant Piping: Comply with requirements in Section 232300 "Refrigerant Piping." Connect to supply and return coil tappings with shutoff valve and union or flange at each connection.

E. Hot-Water Piping: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect to supply coil tappings with shutoff valve, return coil tappings with balancing valve, and union or flange at each connection.

F. Duct installation requirements are specified in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts." Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof-mounted frames. Where indicated, terminate return-air duct through roof structure, and insulate the space between roof and bottom of dehumidification unit.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. 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 260553 "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 between control devices.

C. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

D. Connect smoke detector to fire alarm system.

3.6 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. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, fill water coils with water, and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
2. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Dehumidification unit will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.7 CLEANING

A. Clean dehumidification units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils' entering-air face.

B. After completing system installation, testing, and startup service of dehumidification units, clean filter housings and install new filters.

3.8 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust initial temperature and humidity set points.

3.9 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Perform the following final checks before startup:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Check lubrication of bearings, pulleys, belts, and other moving parts.
6. Set outside- and return-air mixing dampers to minimum outside-air setting.
7. Install clean filters.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

C. Starting procedures for dehumidification units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace malfunctioning motors, bearings, and fan wheels.
2. Measure and record motor's electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

D. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing of dehumidification unit.

E. Startup Report: Report findings during startup. Identify startup steps, corrective measures taken, and final results.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain dehumidification units.

END OF SECTION

SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Common electrical installation requirements.
3. Product / manufacturer substitution procedures.

1.03 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

D. Coordinate sleeve selection and application with selection and application of firestopping.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTION PROCEDURES

A. For any products proposed or manufacturers to be utilized which are not specifically listed on the drawings or within these division 26 specifications, the contractor/bidder must submit the product data for the proposed product to the engineer for review a minimum of 14 calendar days in advance of bid date.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Comply with 2017 National Electrical Code with Addison Amendments (effective February 1, 2021).

C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

D. 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.

E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

F. Right of Way: Give to piping systems installed at a required slope.

G. Provide temporary power during construction. Provide all necessary equipment and labor for complete installation. Coordinate temporary location and connection with the utility provider. All fees shall be paid by the contractor, including all utility usage. If utility is not accessible, provide temporary generator for power during construction and provide all necessary equipment and labor for complete installation.

H. Equipment (Electrical panels, Switch Gear, UPS, Generators, or other systems) should be tested by the installer to verify that it functions according to its design objectives or specifications.

3.02 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

END OF SECTION

SECTION 26 0519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 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.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.03 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

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 NFPA 70.

1.06 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

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:

1. General Cable Corporation.
2. Southwire Company.
3. CME
4. Encore Wire Corporation.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

E. Aluminum wiring shall not be used.

2.02 CONNECTORS AND SPLICES

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:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; Emerson.
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

3.01 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.

3.02 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 Crawlspaces: 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. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

I. Coordinate first paragraph below with Division 26 Section "Underground Ducts and Raceways for Electrical Systems."Division 2 Section "Underground Ducts and Utility Structures."

J. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

K. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

L. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway.

M. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

N. Class 1 Control Circuits: Type THHN-THWN, in raceway.

O. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.03 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 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

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. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. 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.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.06 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.08 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test 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.

D. 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.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

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SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NFPA 70B.

    a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    b. Include recommended testing intervals.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

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 UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper or tinned 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. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators.

2.02 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.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by10 feet.

PART 3 EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

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. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on. insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. 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.

3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. 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.

C. 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.

D. 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.

E. 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.

F. 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.

G. 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 (6-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal and Wood 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.

3.04 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. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) 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.

D. 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 (300 mm) 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.

E. 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.

F. 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.

G. 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.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

C. 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. Make tests at ground rods before any conductors are connected.

    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.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. 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: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. 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.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic 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. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.07 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. 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:

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. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. 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:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
4. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. 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.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. 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. 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:

        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, stainless 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. 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:

        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.

2.02 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

3.01 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 scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted 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 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 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 (90 kg).

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 (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
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.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated or not less than 4 inches (100 mm) 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 (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "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.

3.05 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 (0.05 mm).

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

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SECTION 26 0533

RACEWAY AND BOXES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For testing agency.

F. Source quality-control test reports.

1.05 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

2.01 METAL CONDUIT AND TUBING

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:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

E. EMT: ANSI C80.3.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel or die-cast, set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 NONMETALLIC CONDUIT AND TUBING

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:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40 or EPC-80-PVC as indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.03 METAL WIREWAYS

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:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type for interior applications and Flanged-and-gasketed type for exterior applications, unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.04 NONMETALLIC WIREWAYS

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:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.05 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Prime coating, ready for field painting.

1. 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:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect.

1. 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:

a. Butler Manufacturing Company; Walker Division.
b. Enduro Systems, Inc.; Composite Products Division.
c. Hubbell Incorporated; Wiring Device-Kellems Division.
d. Lamson & Sessions; Carlon Electrical Products.
e. Panduit Corp.
f. Walker Systems, Inc.; Wiremold Company (The).
g. Wiremold Company (The); Electrical Sales Division.

2.06 BOXES, ENCLOSURES, AND CABINETS

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:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: IMC.

3. Underground Conduit: RNC, Type EPC-40 or EPC-80-PVC as indicated, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit or IMC.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway.
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems." Conduit should be suspended from the building structure, not from lay-in ceiling suspension system or similar means.

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Avoid Conduits being placed under the floor slab.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

M. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

N. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

O. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
   d. Attics: 135 deg F (75 deg C) temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

P. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Q. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

R. Set metal floor boxes level and flush with finished floor surface.

S. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

T. Flexible conduit may be used only for final connection to equipment and fixtures, with a maximum 6’ length.

U. When required due to impenetrable wall construction, raceways may be utilized in computer labs. Raceway shall be designed to accommodate 20 technology outlets and 10 quad isolated ground electrical outlets. Raceways cast into the concrete floor system and raised flooring systems will not be used due to the cost. All raceways shall be installed as discretely as possible with little or no disturbance to classroom functionality or aesthetics. Limit raceways to one (1) vertical raceway per wall where possible.

V. Raceways shall be metal with tamper resistant devices. Color to match architect color scheme.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade,

make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

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. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. 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.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.06 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.07 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.03 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.04 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.05 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, 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.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.02 METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.03 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.04 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.05 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.06 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

2.07 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

C. 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)."

2.08 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.09 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be [1 inch (25 mm)]

2.010 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.011 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.01 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. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches above duct. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For 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.

I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer and load shedding.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the 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: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Stenciled legend 4 inches (100 mm) high.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by contractor. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Substations.
h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

END OF SECTION

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SECTION 26 0943
NETWORK LIGHTING CONTROLS

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. This section includes the provision of a lighting control system for the automatic dimming and deactivation of indoor lighting, except for lighting intended for 24-hour operation.

B. This section does not include controls for theater and stage equipment.

C. This section does not include controls for outdoor ball field lighting.

1.3. RELATED SECTIONS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables

B. Section 26 05 33 - Raceways and Conduits for Electrical Systems

C. Section 26 05 53 - Identification for Electrical Systems

D. Section 26 27 26 - Wiring Devices

1.4. REFERENCES

A. NEMA Guide Publication WD 7-2011 Occupancy Motion Sensors.

B. 2015 International Energy Conservation Code (IECC)

1.5. DEFINITIONS

A. Motion Sensor – A sensor that detects when an occupant is in a space. This sensor can be wired or configured to be an occupancy sensor or vacancy sensor.

B. Occupancy Sensor – A motion sensor designed or programmed to automatically turn the lighting in a space “on” when an occupant enters the space (based on major motion) and automatically turn the lighting in a space “off” after the occupant is no longer present or detected (based on minor motion) for a predetermined length of time.

C. Vacancy Sensor – A motion sensor designed or programmed to require an occupant to manually turn the lighting in a space “on” and automatically turn the lighting in a space “off” after the occupant is no longer present or detected (based on minor motion) for a predetermined length of time.

D. Dual Technology Sensor – A motion sensor with both infrared and ultrasonic technologies or both infrared and microphonic technologies.

E. Photocell – A light sensitive sensor used to communicate with a room controller to dim the lighting in a daylight zone according to the ambient lighting entering a space via any method other than electric lighting.

F. Smart Switch – Intelligent programmable switch capable of communicating with the lighting control system in the space to trigger on/off, “scenes”, dimming, etc.

G. Daylight Zone – Area in a space around/about a window, skylight or other fenestration measuring how

far exterior natural lighting can reach into a space. Not all daylight zones can be combined. Luminaires in a daylight zone are to be controlled separately from the luminaires in the rest of the space. Some daylight zones, after they are identified in a space, will not require any change to the lighting controls already shown and may therefore be disregarded. Those will usually be deleted from the reflected ceiling plans to prevent confusion.

H. Room Controller – The local space lighting controller that interfaces with the luminaires, motion sensors, photocells, smart switches, etc. in each space to control on/off, “scenes”, dimming, and daylight harvesting. This may include the power pack, distributed controller, ballast interface modules, interface components, etc. Some or all of this function may be an integral part of the luminaires in the space.

I. Enhanced Building Controls (EBC) – A building interface (digital control system) intended to group all room controllers into a networked lighting control system to allow load shedding, scheduling events, remote programming, remote control via software interface, etc.

J. Functional Testing: Start-up or testing performed by the manufacturer or certified representative to verify the operation of the complete lighting control system.

K. Commissioning Agent: Third party hired by Contractor or Owner to meet IECC commissioning requirements.

1.6. DESIGN REQUIREMENTS

A. The system shall include all required devices for a complete and proper operating system to automatically control the lighting to meet the intent of the IECC. The system may include but not be limited to motion sensors, room controllers, enhanced building controls (only if required), low voltage control wiring, photocells, smart switches, intelligent luminaires and all required boxes.

B. Sensor design and layout: Provide the quantity of motion sensors required for complete and proper coverage without gaps within the range of coverage of controlled areas. Rooms shall have 100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms that are to be provided with sensors. Provide additional sensors if required to properly and completely cover the respective room. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

C. Not all required components are shown on the plans. The drawings are diagrammatic only, depicting some devices and approximate locations for device placement. Contractor responsible for providing shop drawings for approval, including a complete designed systems and all components, including but not limited to sensors, switches, network controllers, wiring diagrams, and product data. Shop drawings shall be on a set of standard 30” x 42” floor plans and depict location of all devices proposed to be installed.

D. A distributed lighting control system is preferred.

E. Battery operated devices and controls are not acceptable.

F. Refer to Luminaire Schedule for additional requirements and more information.

1.7. PERFORMANCE REQUIREMENTS

A. All Spaces:

I. Refer to the reflected ceiling plans for additional information and requirements for controlling the lighting in various areas throughout the building. For projects beyond the scope of a single system, multiple systems shall be networked together to accommodate any size requirement.

II. All portions of the controls mounted above ceiling are to be plenum rated.

III. If a UPS provides backup/auxiliary power to any luminaires, then power shall be provided for all lighting controls in those spaces such that all functions of the lighting control system remain operable under any power condition.

IV. Wiring between sensors and control units shall be 18 AWG minimum (stranded preferred) or

CAT5/5e/6. Wiring shall be plenum rated in plenum spaces and UL listed. Pre-terminated low voltage wiring from the lighting controls manufacturer is preferred.

V. See the Sequences of Operation article in this specification section.

B. Motion Sensors

I. All motion sensors are to be corner (preferred) or ceiling mounted except in single toilets or small closets (< 40sqft) or unless otherwise indicated on the drawings.

II. Where allowed, wall-mounted motion sensors shall be suitable for 120v or 277v lighting.

III. All motion sensors shall be dual technology.

IV. All motion sensors to be set to 20 minute time delay and adjusted to maximum sensitivity, unless otherwise noted on the drawings. Must be capable of being set down to 5 minutes and 1 minute for testing.

V. Coverage areas for major motion and minor motion shall be determined in accordance with Section 3 of NEMA WD 7 Guide.

VI. Ultrasonic technology shall utilize a frequency that does not interfere with other sensors, hearing aids, smartboards, etc.

VII. All motion sensors on this project shall have masking or internal shielding available to control coverage pattern in the field. Stickers or other external adhesive masking will not be accepted.

C. Timer Switches: A timer switch control function shall have an override not exceeding 2 hours to meet code.

D. Smart Switches

I. The smart switch shall control the luminaires in the space for all on/off, dimming and/or “scene” controls.

II. For device color and cover/trim color, provide submittal to engineer for final selection.

III. The smart switch is to be used as a manual override when used with vacancy sensors.

IV. Where keyed switches are indicated on the plans, the “off” feature of the smart switch is to be disabled for a schedule similar to 7a-5p. Coordinate exact schedule with Owner.

V. All programmable switches are to be engraved or internally labeled so that the function of each button is clearly identified. All labeling or engraving must be of high quality and be provided by the lighting system manufacturer.

E. Time Clock Feature: Seven day clock, capable of seven different day types per week, automatic holiday “shutoff” feature for 24 hours, 12 hour minimum program backup capabilities to meet code.

F. Room Controller

I. In the event of a hardware or software or component failure, the lighting in the space is to default to the “ON” position.

II. Provide adequate room controllers in each space for proper operation of the lighting to meet all code requirements and design intent shown on the plans.

III. All room controllers shall utilize zero-crossing circuitry.

1.8. PRODUCT DATA

A. Submit product data for all components and accessories of the lighting control system including, but not limited to:

I. Motion sensors

II. Photocells

III. Smart switches

IV. Time switches

V. Room controllers

VI. Enhanced building controls

VII. Software

VIII. Lighting contactors

IX. Low voltage wiring

X. Intelligent luminaires

B. Product data for motion sensors shall clearly indicate coverage areas for major motion and minor motion determined in accordance with the testing procedures of NEMA WD 7 Guide.

C. Any product submitted other than from the manufacturers listed below in Part 2 will be rejected.

1.9. SHOP DRAWINGS

A. Submit shop drawings of each reflected ceiling plan in this project showing the specific locations of all parts of the lighting control system including motion sensors, photocells, smart switches, room controllers, enhanced building controls, etc. Motion sensors shown shall include sensor type, sensor mounting, and other pertinent data to allow evaluation of the proposed system.

B. Submit a wiring diagram for all motion sensors, photocells, smart switches, room controllers, etc.

1.10. CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide 2 complete sets of operating, maintenance, and adjustment instructions and other information necessary for proper operation of the lighting control system. These documents shall be included as part of the project operating and maintenance manuals.

B. As-built Drawings: Provide 2 complete sets of as-built reflected ceiling plans showing the location and wiring configuration of all motion sensors, room controllers, photocells, etc.

C. Warranty: Provide 2 copies of warrantees.

D. Training Documentation: Provide a letter in the final documents documenting that Owner (give name of person, date, duration, and content of training) received training required in this section.

E. System Functional Testing Documentation: Provide two (2) copies of documentation reporting the manufacturer's start-up, adjusting, and final testing of the completed installation. Include a list of controllable points to the BMS provider upon completion of lighting controls functional testing.

F. Software Maintenance Agreement: Provide 2 copies of the software maintenance agreement.

1.11. REGULATORY REQUIREMENTS

A. UL Label: All lighting control system products shall be UL-labeled, individually and as a system, for the specific applications utilized on this project.

1.12. PRE-INSTALLATION MEETINGS

A. Meet with the manufacturer of the lighting controls on-site to review installation, wiring methods and exact equipment locations of all components prior to starting installation. At this meeting Contractor shall be trained by the manufacturer or vendor on the installation, setup and functionality of the system. Failure to have this meeting will result in Contractor assuming full responsibility of all costs incurred to move controls and sensors, replace equipment due to product damage, costs due to installation errors or failure to meet the full intent of the design.

B. Provide a product demonstration by the manufacturer of the lighting control system including a

sample of each piece and part demonstrating a complete working system. If a product demonstration is not acceptable by Owner or Architect, provide, at additional cost, a mock-up of required space types with complete controls for owner / engineer / construction administration review before installation throughout the building

1.13. STORAGE AND PROTECTION

A. Store all product in accordance with manufacturer's storage requirements.

1.14. WARRANTY

A. Provide a five year parts and one year labor warranty on the entire control system. Warranty coverage shall begin at the time of Project Substantial Completion.

1.15. SYSTEM STARTUP

A. Provide the initial programming and start-up of the system.

B. After system startup and prior to substantial completion of the project, require the manufacturer to test the operation of the complete system (all pieces, every space) to ensure the proper operation of the system throughout the range of building operating conditions. Provide documentation of such functional testing in the closeout submittals. Do this functional testing on all projects, regardless of other additional commissioning or testing requirements.

1.16. OWNER'S TRAINING

A. After functional testing is complete, require the manufacturer to provide a minimum of 4 hours of on- site training to Owner's personnel in the operation, adjustment, and maintenance of the system. Record the training for the Owner. Provide documentation of such training in the closeout submittals.

1.17. THIRD PARTY COMMISSIONING

A. In addition to functional testing by Contractor and the manufacturer, additional third party commissioning is required to meet IECC requirements. The manufacturer shall be present during the third party commissioning process.

1.18. MAINTENANCE SERVICE

A. Provide a three-year manufacturer's software service agreement with the system. The agreement shall cover all minor updates, bug fixes and maintenance to the software of the system to maintain all original functionality. The software service agreement shall start at the time of substantial completion.

1.19. SYSTEM SUPPORT

A. Provide five-year complete system support starting from substantial completion. The entire lighting control system (hardware and software) shall be included in the support. The support shall include phone and email communication (as a minimum) for the duration of the support. The system support shall include all technical support, hardware and software questions, warranty help, etc.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. If they comply with these specifications, products of the following, and only the following, manufacturers will be acceptable:

I. Douglas Lighting Controls
II. Easylite Ballasts and Controls, Inc.

III. Intelligent Lighting Controls, Inc.
IV. Leviton Mfg. Company Inc.
V. Lighting Control & Design, Inc.
VI. Lightolier Controls; a Genlyte Company.
VII. Lithonia Lighting; Acuity Lighting Group, Inc.
VIII. Lutron Electronics Company, Inc.
IX. MicroLite Lighting Control Systems.
X. NexLight; Northport Engineering Group.
XI. Square D; Schneider Electric.
XII. Starfield Controls, Inc.
XIII. Touch-Plate, Inc.
XIV. TRIATEK, Inc.
XV. ULTRAWATT Energy Systems, Inc.
XVI. Watt Stopper (The).

B. Other manufacturers must be approved prior to bid.

2.2. MANUFACTURED UNITS

A. All parts of the lighting control system shall be manufactured by the same company and shall be aesthetically compatible. i.e., from the same product line or family of products.

B. All sensors shall be from the latest release generation. Do not mix product of different releases or generations.

PART 3 EXECUTION

3.1. SITE VERIFICATION OF CONDITIONS

A. If the work is to be performed in an existing facility, visit the site of the proposed work and observe its conditions so that you may be fully informed as to the materials, labor, workmanship and conditions under which the work is to be done. If an existing lighting control system exists, then the new system shall work with the existing system.

B. No allowances shall be made on account of any errors, negligence or failure to be aware of the condition of the existing site.

3.2. INSTALLATION

A. General

I. Provide all lighting controls as required, in accordance with manufacturer's written instructions and project drawings, and applicable requirements of the NEC / IECC 2015 edition, and recognized industry practices to ensure that products serve the intended function.

II. Provide the room controller as required located above the ceiling above the switches near the exit door. Provide a permanent label on the ceiling t-grid to identify its location. The label material shall be as described in section 26 05 53. The label shall say “Lighting Controller”. It is acceptable for a room controller to serve more than one space.

III. Provide conduit and wiring in accordance with specification sections 26 05 33 and 26 05 19.

B. Shop Drawing Preparation: At least five working days prior to bid time, provide a set of floor plan drawings and a copy of these specifications to the manufacturer for the purpose of system layout with quantities and creating shop drawings for the owner. Coordinate with the manufacturer to determine the required medium (hard copy or electronic) and the format required by the manufacturer.

C. Sensor Design and Layout by Manufacturer:

I. Refer to Design Requirements article regarding sensor design and layout.

II. Exact locations of control unit hardware boxes shall be based on observing good installation practice and shall be coordinated with other elements of the reflected ceiling plan. Control unit hardware shall be fully concealed.

III. Select the appropriate type of sensor for complete coverage of each space.

3.3. SEQUENCES OF OPERATION

A. Lighting Controls

I. The smart switch shall be required to be pressed to turn the lights on in all spaces where a vacancy sensor is required. Otherwise, an occupancy sensor may automatically turn the luminaires on. Two minutes prior to turning the lights off, the lighting controls shall dim the luminaires in the space to 50% of their previous output as a notification to the occupants that the controls will soon turn the lighting off. A momentary “blink” is allowed if luminaires are not dimmable. If the motion sensor is not triggered in two minutes, the lighting in the space is to turn off. If the motion sensor is triggered, the lighting controls shall dim the lighting back up to the previous lighting level and timeout is restarted. In spaces with timer switches, the system shall accept an override signal at any time either before or after the lighting is turned off. The occupant shall not be required to wait for the lights to go out before issuing the override.

II. Where shown on the plans, a photocell is to be used to measure the light level and signal to the room controller to dim the luminaires continuously (from 100% to 15% or lower, including off) in the daylight zone to maintain a consistent (within +10% and -0%) lighting level in the space.

3.4. MANUFACTURER’S FIELD SERVICES

A. Coordinate with the sales representative to coordinate the below requirements with the manufacturer.

I. The manufacturer shall provide instruction at the start of the job to Contractor regarding the proper installation of the system.

II. As part of the system startup process, the manufacturer shall provide all initial field programming of the system.

III. Using certified factory representatives, the manufacturer shall inspect the finished installation against the shop drawings and installation instructions.

IV. Using certified factory representatives, the manufacturer shall do functional testing of the finished installation. Submit documentation of the functional testing in accordance with Part 1 of this specification.

3.5. ADJUSTING

A. Motion sensors may be affected by various conditions in the room. It may be necessary for Contractor to make adjustments, change the location or type of sensor to obtain proper operation in a specific room. Contractor/equipment manufacturer shall have final responsibility for proper operation and coverage of the system in each room and should therefore make labor allowance for such changes and adjustments. Contractor is also responsible for acquiring approval from Engineer for any changes or deviations from project specifications.

B. Work with the manufacturer to correct all findings from manufacturer functional testing.

C. Work with the manufacturer to correct all findings made by the third party commissioning agent or registered design professional, whichever entity performs the commissioning service. This contractor is responsible for the entire lighting control system and luminaires to pass the commissioning inspection and reporting.

3.6. OWNER’S TRAINING AND DEMONSTRATION

A. Upon completion of testing and adjustment, demonstrate operation of the system to repre-

sentatives of Owner.

B. Instruct Owner's personnel in proper maintenance, adjustment, and operation of the motion sensor lighting controls.

C. Discuss with Owner the time clock feature programming requirements (on/off times and school schedule) and teach them to program the clock feature to match the required schedule.

D. Upon completion of testing and adjustment (commissioning), Contractor and a direct employee of the equipment manufacturer (who is already familiar with the details of the project) shall demonstrate operation, proper maintenance, troubleshooting and adjustment of the lighting control system and all sensors throughout the building. Owner shall receive a minimum of 4 hours and a maximum of 8 hours in an on-site training session. The length of the training session shall be at the discretion of Owner. Training session shall be filmed/recorded and provided to Owner. The training shall cover the following areas in detail:

I. Scope of system: Review the as-built documentation with Owner to detail extent of system. Identify locations of all wall stations, wiring, and panels that fall within the scope of the lightSing control system. Define clear lines of scope between lighting control system and EMS functions if applicable.

II. Operation of system: Cover normal operation of switches, push- buttons, LCD interfaces and software (if provided). Provide documentation to Owner showing the operational zoning of controlled circuits and all time-clock events programmed into the Lighting Control System. Show Owner how to change and add/delete events.

III. Maintenance and Troubleshooting of system: Detail any required or optional preventive maintenance actions required of Owner. Review step-by-step procedures to troubleshoot all possible failure modes of each component type of the lighting control system. Cover procedure to get lights turned on in any space containing a lighting control system in the event the control system fails. Identify any specialized equipment necessary to support all the above actions.

IV. Service and Support of system: Identify nearest direct support contact for the manufacturer and provide both telephone and email contact details.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protection Device.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, surge protection device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. 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. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

F. Operation and Maintenance Data: For panelboards 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. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than 7 days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 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.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard, in addition to the spares to be installed within the panelboard in accordance with panel schedules on drawings.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets, as indicated on drawings.

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 and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

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. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

   a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Galvanized steel.
   c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top or bottom as required.

C. Phase, Neutral, and Ground Buses:

1. Material: Where “Aluminum” indicated on the drawings, use tin-plated aluminum. Where “Copper” indicated on the drawings, use 98% conductivity hard drawn copper.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Where indicated on the drawings; adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Where indicated on the drawings, neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Main and Neutral Lugs: Compression type, suitable for use with conductor material.
2. Ground Lugs and Bus-Configured Terminators: Mechanical type.
3. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
4. Subfeed (Double) Lugs: Compression type, suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
5. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. 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, listed and labeled for series-connected short-circuit rating by an NRTL.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.
2. General Electric Company.
3. Siemens.
4. 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 as indicated on the drawings.

D. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers (as indicated on the drawings), replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.
2. General Electric Company.
3. Siemens.
4. 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-replicable 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 (where indicated on drawings): Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Shunt Trip (where indicated on drawings): 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    f. Undervoltage Trip (where indicated on drawings): Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    g. Alarm Switch (where indicated on drawings): Single-pole, normally open contact that actuates only when circuit breaker trips.
    h. Key Interlock Kit (where indicated on drawings): Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    i. Zone-Selective Interlocking (where indicated on drawings): Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    j. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    k. Handle Padlocking Device (where indicated on drawings): Fixed attachment, for locking circuit-breaker handle in on or off position.
    l. Handle Clamp (where indicated on drawings): Loose attachment, for holding circuit-breaker handle in on position.

2.4 PANELBOARD SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology.
2. Eaton Electrical Inc.
3. Emerson.
4. General Electric Company.
5. Siemens.
6. Square D; a brand of Schneider Electric.

B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:

    a. LED indicator lights for power and protection status.
    b. Audible alarm, with silencing switch, to indicate when protection has failed.
    c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.

2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.

3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.

    a. Line to Neutral: 70,000A.
    b. Line to Ground: 70,000 A.

c. Neutral to Ground: 50,000A.

4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
5. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, three-phase, four-wire circuits shall be as follows:

a. Line to Neutral: 400 V for 208Y/120.
b. Line to Ground: 400 V for 208Y/120.
c. Neutral to Ground: 400 V for 208Y/120.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. 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 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Equipment Mounting: Install floor mounted panelboards on concrete bases, 4-inch nominal thickness, unless otherwise indicated on drawings.

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 panelboards, 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 panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount top of trim 90 inches above finished floor unless otherwise indicated.

E. 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.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch empty conduits from recessed panelboards into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits from recessed panelboards into raised floor space or below slab not on grade, where applicable.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

3.3 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 after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer 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."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. 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.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. 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.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

C. Circuit changes made during load balancing may negate color-coding of phases and circuits. If load balancing proves undesirable or is to be performed by others, delete paragraph below.

D. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Snap switches and wall-box dimmers.
3. Wall-switch and exterior occupancy sensors.
4. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.04 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. Field quality-control test reports.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

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 NFPA 70.

1.06 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.07 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: One for every 10, but no fewer than one.
2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.
3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TR8300.

b. Hubbell; HBL8300SG.
c. Leviton; 8300-SGG.
d. Pass & Seymour; 63H.

2. All receptacles installed shall comply with NEC 406.12 and include a safety cover.

2.03 GFCI RECEPTACLES

A. General Description: Straight blade, 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:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.

2.04 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches to be Ivory.

C. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

D. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221PL for 120 V and 277 V.
b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

E. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

F. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

G. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L.

2.05 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; with single-pole or three-way switching. Comply with UL 1472.

2.06 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 6111 for 120 V, 6117 for 277 V.
b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.

2. 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.

2.07 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: Smooth, high-impact thermoplastic.
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 , thermoplastic with lockable cover.

2.08 FLOOR SERVICE FITTINGS

A. Type: Modular, flap-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

2.09 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
3. Square D/ Schneider Electric.
4. Thomas & Betts Corporation.
5. Wiremold Company (The).

B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: Flush type with four simplex receptacles and space for four RJ-45 jacks.
2. Size: Selected to fit nominal [3-inch] [4-inch] cored holes in floor and matched to floor thickness.
3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
4. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.

2.010 FINISHES

A. Wall Plate Color: Ivory, or as selected by Architect to match surrounding wall finish.

B. Wiring Device Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. Isolated-Ground Receptacles: Orange.
4. Dedicated Receptacle Circuit: Orange.

PART 3 EXECUTION

3.01 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. Pigtailing 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 left.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

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.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. 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 ones, and retest as specified above.

C. Test straight blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

END OF SECTION

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SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers 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. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.07 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.08 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 PRODUCTS

2.01 EXISTING EQUIPMENT

1. Where enclosed switches and circuit breakers are being provided in an existing switchboard or panelboard, match existing manufacturer, type and KAIC rating.

2.02 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.
2. General Electric Company.
3. Siemens.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 240 and 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. 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; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit (where indicated on drawings): Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

4. Class R Fuse Kit (where indicated on drawings): Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit (where indicated on drawings): One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Compression type, suitable for number, size, and conductor material.
8. Service-Rated Switches (where indicated on drawings): Labeled for use as service equipment.

2.03 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.
2. General Electric Company.
3. Siemens.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 240 and 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. 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; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit (where indicated on drawings): Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit (where indicated on drawings): One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Compression type, suitable for number, size, and conductor material.

2.04 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.
2. General Electric Company.
3. Siemens.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. 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.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection (where indicated on drawings): Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip (where indicated on drawings): Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip (where indicated on drawings): Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts (where indicated on drawings): One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.05 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 9.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

E. All low-voltage circuit breakers shall be thermo-magnetic breakers (including breakers with GFI protection). Digital solid state breakers shall not be used unless approved by the District.

F. Provide surge protectors on all distribution panelboards. Surge protectors shall be mounted as close as possible to panels.

3.03 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. 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.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. SFollow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer. Retain option in paragraph below if the indicated Section is included in the Contract Documents.

END OF SECTION

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SECTION 26 5100

INTERIOR LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps,
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections include the following:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.03 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.04 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast.
4. Energy-efficiency data.

5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 23 Section "Diffusers, Registers, and Grilles."
6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, and Grilles."
7. Life, output, and energy-efficiency data for lamps.
8. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
    b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power and control wiring.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Structural members to which suspension systems for lighting fixtures will be attached.
4. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.

5. Perimeter moldings.

D. Samples for Verification: Interior lighting fixtures designated for sample submission in Lighting Fixture Schedule. Each sample shall include the following:

1. Lamps: Specified units installed.
2. Accessories: Cords and plugs.

E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

F. Qualification Data: For agencies providing photometric data for lighting fixtures.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

I. Warranties: Special warranties specified in this Section.

J. DesignLights Consortium Certification for LED fixtures. Provide lighting facts documentation.

1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. All LED fixtures are to be tested and should adhere to IESNA LM79 testing standards for lumen output and depreciation.

F. All LED fixtures are to be tested to LM80 standards.

G. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

H. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.07 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

C. Warranty for LED luminaires: Manufacturer's standard form, made out to Owner and signed by luminaire manufacturer agreeing to replace any component of the luminnaire that fails in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period for LED luminaires: Five years from date of Substantial Completion.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger Data: One for each emergency lighting unit.
4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1. Basis-of-Design Product: The design for each lighting fixture is based on the product named on the Light Fixture Schedule on the drawings. Subject to compliance with requirements, provide either the named product or a comparable product by another manufacturer. Substitutions to the named product are subject to the substitution requirements indicated in Division 26 Section "Common Work Results for Electrical."

2.02 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

E. 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.

F. 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.

G. 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 (3.175 mm)] <Insert thickness> minimum unless different thickness is indicated.
    b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

I. Air-Handling LED Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 23 Section "Diffusers, Registers, and Grilles."

1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
2. Heat Removal Units: Air path leads through lamp cavity.
3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.
4. Dampers: Operable from outside fixture for control of return-air volume.
5. Static Fixture: Air supply slots are blanked off, and fixture appearance matches active units.

J. If a generator or UPS provides emergency power to any emergency luminaires, all emergency luminaires shall turn on to maximum lumen output. If battery packs provide power for emergency lighting, all emergency luminaires shall turn on to maximum lumen rating of the battery pack.

2.03 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction. Fixtures to be vandal resistant.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
    g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.04 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.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.05 LED LUMINAIRES AND ACCESSORIES

A. Description:

1. All fixtures are to be tested and should adhere to IESNA LM79 testing standards for lumen output and depreciation.
2. All fixtures are to be tested to LM80 standards.
3. All fixtures are to be DLC certified.
4. All fixtures are to be rated to deliver L80 performance for a minimum of 50,000 hours.
5. All fixtures are to be equipped with 0-10V dimming drivers.
6. Color temperature shall be as indicated in Light Fixture Schedule on plans.

2.06 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

3.01 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

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. Exit and emergency egress lighting shall be connected to a branch circuit serving lighting in the area ahead of any switching.

3.02 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

SECTION 31 6329
DRILLED CONCRETE PIERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Drilling and cleaning pier holes
2. De-watering of shafts and removal of spoil
3. Casing pier holes

B. Products Installed, Not Furnished Under This Section
1. Concrete and reinforcing steel
2. Anchor bolts, templates and dowels
3.

1.02 REFERENCES (Latest Edition)

A. Codes and Specifications
1. Standards and specifications provided by the Association of Drilled Shaft Contractors
2. American Concrete Institute (ACI):
a. ACI 336.1, Specification for the Construction of Drilled Piers
b. ACI 336.3, Report on Design and Construction of Drilled Piers

1.03 BASIS FOR BIDS

A. Definitions
1. Ground surface: Final grade based on finish floor elevations in Contract Documents.
2. Pier depth: Total depth of pier calculated as the sum of:
a. Depth from ground surface to top of bearing stratum
b. Depth that casing extends into bearing stratum
c. Required penetration into bearing stratum
3. Bid depth: Pier depth based on top of bearing stratum elevation in Contract Documents.
4. Pay depth: Actual depth of pier as installed.

B. Contract Sum
1. Calculate Contract Sum based on bid depth.
2. Do Not Include temporary casing in Contract Sum.

C. Unit Prices
1. Piers: provide add and deduct unit price per linear foot shorter or longer than bid depth
a. Above bearing stratum
b. Within bearing stratum.
c. No additional depth of penetration into bearing stratum will be included in the pay depth unless required in writing by the inspecting agency.
2. Casings: provide add and deduct unit price per linear foot for steel casing installation and removal. Base unit price on actual length of temporary steel casing measured from ground surface to bottom of casing.
3. Provide unit prices for complete Work including labor, materials, overhead, taxes and profit.

1.04 QUALITY ASSURANCE

A. Qualifications
1. Contractor: at least 3 years of experience in similar applications
a. Relevant experience to anticipated subsurface materials, water conditions, shaft sizes and special techniques required
2. Demonstrate to Architect dependability of equipment and techniques to be used, when requested.

B. Conform to requirements of ACI 336.1, except as modified by requirements of this Section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store reinforcing cages off ground and protect from contamination by dirt, grease and corrosion.

B. Deliver concrete to site in timely manner and in sufficient quantities to allow concreting of each pier as monolithic unit.

C. Coordinate delivery of concrete to allow placement to begin within 8 hours of completion of drilling.

PART 2 PRODUCTS

2.01 MATERIALS - Refer to related sections for materials installed, not furnished under this section.

2.02 FABRICATION

A. Prior to drilling pier holes, fabricate reinforcing cages in stock lengths suitable for cutting to required lengths. Bend reinforcing as detailed.
   1. Do not splice vertical reinforcing
   2. Do not use cross wire ties that would interfere with tremie pipe or concrete free falling down the center of the cage.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation, review subsoil investigation report for site provided by Owner and become thoroughly familiar with anticipated subsoil conditions.

B. Examine site for obstructions to drilling, such as power lines, utilities, material stockpiles, boulders and uneven surfaces. Report anticipated problems to Architect in timely manner so as not to delay schedule of Work.

C. Locate existing underground utilities and notify Architect of conflicts with Work.

3.02 PREPARATION

A. Have ready at site equipment anticipated to be necessary for successful installation of piers, including power augers, core barrels, tremies, hoppers, chutes, and casing, as applicable.

B. Maintain in ready condition dowels, templates, and anchor bolts required for pier installation.

3.03 INSTALLATION

A. Drilling Straight Shaft Pier Holes
   1. Drill pier holes with power augers or core barrels suitable for subsoil conditions at site.
   2. Drill pier holes of required diameters to bearing stratum and penetrate bearing stratum to required depths below top of stratum.
   3. Where casing is required, increase pier hole diameter as necessary to accommodate casing having inside diameter not less than required shaft diameter to depth necessary to seal shaft.
   4. Where casing is required, measure required depth of penetration into bearing stratum from top of stratum or from bottom of casing, whichever is deeper from ground surface.

B. De-watering Pier Holes
   1. Remove standing water from pier holes to within 3 inches of hole base by bailing or pumping.
   2. Where flowing water is encountered, or required water level cannot be maintained, use casing.

C. Casing Pier Holes
   1. Where flowing water or caving soil is encountered use temporary steel casings to seal sides of shaft.
   2. Provide watertight, steel casings of adequate strength to withstand handling stresses and concrete and earth pressures.
   3. Extend casings only to depth required to seal off water or caving soil.

4. Extract casings in vertical lifts, maintaining adequate head of concrete to prevent caving of soils. Do not rotate casing during removal.

D. Placing Reinforcing Cages, Dowels and Anchor Bolts
1. Place reinforcing steel cages accurately in shafts and hold in position during placement of concrete.
2. Place dowels and anchor bolts in position and maintain proper location and elevation with templates.
3. Use spacer rollers to maintain position of cage within shaft and to maintain minimum 3 inches of concrete cover without casing, and 4 inches of concrete cover with casing.
4. Use end blocks to support cage at required elevation maintaining proper clearance at base of pier.

E. Placing and Consolidating Concrete
1. Clean pier shafts of accumulated loose material before placing concrete and remove water to within 3 inches of base of shaft.
2. Place concrete within 8 hours of drilling.
3. Place concrete using collection hopper with steel outlet pipe to direct concrete down the center of the shaft. Placing concrete directly into the shaft from concrete truck chute is not allowed.
4. Extend tremie pipe as required to limit concrete free fall to 10ft max.
5. Place concrete in one continuous operation for each pier.
6. Consolidate top 6 feet of each pier with concrete vibrator.
7. Where water rises to top of pier during placement, remove over-wetted concrete and replace with sound, dense material.
8. Remove and replace portions of concrete that become contaminated with mud or spoil material during placement.
9. Where tops of pier holes become mushroomed during drilling or installation procedures, use round forms to maintain constant diameter.

F. Tolerances
1. Maximum lateral variation off centerlines: 3 inches
2. Plumbness of vertical piers within 1 ½ percent of shaft depth to bearing stratum.
3. Shaft diameter: plus 2 inches, minus 0
4. Top of pier elevation: plus one inch, minus 3 inches
5. Penetration into bearing stratum: minus 0, plus 1 foot.
6. Levelness of pier bottom bearing surface: within 1 vertical to 12 horizontal of level
7. Placement of dowels at tops of piers: plus or minus 1 inch horizontal and vertical. Set dowels in open shaft prior to concrete placement, unless wet setting of dowels is approved by Architect.
8. Placement of anchor bolts: plus or minus ¼ inch horizontal, plus or minus ½ inch vertical.

3.04 FIELD QUALITY CONTROL

A. Testing Laboratory and Inspection Services
1. Inspect drilling of each pier hole
   a. Determine location of required bearing stratum
   b. Measure depth to bearing stratum from ground surface
   c. Measure overlap of casing into the bearing stratum where casing required.
   d. Measure depth of penetration into stratum
   e. Measure shaft diameters.
   f. Measure casing diameter where casing required
   g. Inspect condition of base prior to placing concrete
2. Inspect reinforcing cages
   a. Check bar sizes and quantity
   b. Check tieing and splicing of cages
   c. Monitor placement and securement techniques
3. Monitor concrete placement

a. Monitor time interval between drilling and placement.
b. Inspect placement techniques and conditions.
c. Inspect concrete quality at tops of shafts.

4. Material Tests: refer to sections for products installed, not furnished under this section.
5. Field Conditions: where un-anticipated subsurface conditions prevent proper installation of piers, do not proceed with Work until directed by Architect.
6. Pier Log: for each pier record the following and submit to Architect for review:
   a. Identification mark
   b. Plan view identifying pier location
   c. Shaft diameter
   d. Top of bearing stratum elevation
   e. Bottom of pier elevation
   f. Penetration of bearing stratum
   g. Pier reinforcing (vertical bars and ties)
   h. Steel cage length
   i. Depth and diameter of casing, where casing required
   j. Top of Pier Elevation
   k. Concrete quantity
   l. Date and time drilling completed
   m. Date and time concrete placement begun and completed
   n. Plumbness variation
   o. Condition of drilled hole before placement of concrete
   p. Notes regarding piers not in compliance with Contract Documents

B. Adjusting
1. Re-drill piers for which time lapse between drilling and concreting exceeds maximum as determined by Architect at no additional cost to Owner.
2. Replace piers installed without required inspection as directed by Architect at no additional cost to Owner.
3. Test and/or correct pier installations suspect of deficient quality as directed by Architect at no additional cost to Owner.
4. Pier shafts larger than required diameter, except where casing is required, may require additional vertical reinforcing, as instructed by Architect at no additional cost to Owner.
5. Remove mushrooms - before concrete cures, remove excess concrete from tops of piers to maintain pier shafts of constant diameter.

C. Clean-up
1. Remove spoil and debris from the site and legally dispose.

END OF SECTION