Jones Gillam Renz Architects

Address
730 N 9th St.
Salina, KS 67401

1881 Main St., Suite 301
Kansas City, MO 64108

Contact
jgr@jgrarchitects.com
(785) 827-0386

Web
jgrarchitects.com

Project Manual

for

CLYDE COMMUNITY HALL RENOVATION
401 Washington Street
Clyde, Kansas

REVISED
April 16, 2026

JGR Project No. 25-3508

CLYDE COMMUNITY HALL
RENOVATION
401 WASHINGTON STREET
CLYDE, KANSAS

Project No. 25-3508

DATE OF DRAWINGS AND SPECIFICATIONS April 16, 2026

OWNER

CLYDE COMMUNITY HALL INC.
Brad Blackwood, Board Chairman
401 Washington Street
Clyde, KS 66938
785 243 0085

ARCHITECT

JONES GILLAM RENZ ARCHITECTS
730 N. Ninth, Salina KS 67401
Charles Renz, Project Architect
Mark L. Regier, Project Manager
785 827 0386

STRUCTURAL

BOB D. CAMPBELL & CO.
4338 Belleview, Kansas City, MO 64111
Chris Beverlin, P.E.
816 531 4144

MECHANICAL/ELECTRICAL

LST CONSULTING ENGINEERS
4809 Vue Du Lac Place, Suite 201
Manhattan KS 66503
John Lewis-Smith, P E
785 587 8042



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CLYDE COMMUNITY HALL
Renovation
Clyde, Kansas

JONES GILLAM RENZ ARCHITECTS
730 N. 9th, Salina KS 67401
785.827.0386

Project No. 25-3508

INVITATION TO BID

1. Sealed Bids will be received by **Clyde Community Hall Inc.** for the furnishing of all labor and materials as hereinafter specified for the renovation of Clyde Community Hall, Clyde Kansas. Bids will be accepted and opened in the **Clyde Community Hall, 401 Washington Street, Clyde Kansas until 2:00 p.m. Wednesday, May 27, 2026**. Bids received after this time will not be accepted. Bids will be opened and read publicly

2. PROJECT SCOPE (includes, but not limited to:)
   A. Renovation of Clyde Community Hall. Project will consist of:
      1) Alternate bid for exterior masonry tuckpointing, repair and staining.
      2) Replacement of exterior concrete stairs with concrete ramp.
      3) Installation of metal exterior stair.
      4) Replacement of all utilities (sewer, water, electrical).
      5) Replacement of exterior windows with fixed fiberglass insulated units.
      6) Replacement of doors and frames.
      7) Demolition of existing interior walls, ceilings and finishes.
      8) Installation of new gypsum board over metal stud walls.
      9) Installation of new acoustical suspended ceiling system.
      10) Painting of walls.
      11) Removal of all electrical power and devices. Installation of new.
      12) Removal of all light fixtures and wiring. Installation of new.
      13) Removal of hall HVAC equipment and ductwork. Installation of new.
      14) Removal of all plumbing fixtures, piping and venting. Installation of new.
      15) Installation of fire sprinkler and fire alarm systems.
      16) Alternate bid for new interior stairway and elevator shaft (no elevator).
      17) Alternate bid to install concrete floor slab in basement.
   B. Project is subject to Build America, Buy America Act.
   C. Project is subject to Community Development Block Grant requirements including Davis-Bacon Wage Rates.

2. The GENERAL CONSTRUCTION CONTRACT will include General Construction, Mechanical, and Electrical Work combined into one Contract.

3. As a condition precedent to Contract Award, type of work completed and proposed Subcontractor will be carefully considered. Owner is not obligated to accept lowest or any other bid.

4. The DRAWINGS, SPECIFICATIONS, and CONTRACT DOCUMENTS may be obtained by bona fide Prime Bidders (General, Mechanical, and Electrical) from Jones Gillam Renz Architects at 730 North 9th Street Salina KS 67401, 785.827.0386 upon deposit of $200.00 for one set of GENERAL CONSTRUCTION, MECHANICAL AND ELECTRICAL DRAWINGS, and SPECIFICATIONS.

   Those who submit bids may obtain refund by returning sets in good condition no more than two (2) weeks after bids have been opened. No refund of deposit will be made to Contractors not submitting a bid, unless all documents are returned in good condition five (5) days prior to time of receiving bids. 2nd set of Drawings and Specifications may be purchased by Prime Contractors for $200.00 (no refund)

   Drawings and specifications will be available for review on the website at www.jgrarchitects.com. **General Contractors who are bidding from documents via website or plan room, must contact the office of Jones Gillam Renz 785.827.0386 to register as an official Plan Holder. Contact Mark Regier, mregier@jgrarchitects.com with questions.**

   Partial Sets of Contract Drawings and Documents or individual sheets may be obtained by Subcontractors, material suppliers, etc., (no refund) for the following amounts:
   Drawings - $3.50 per sheet
   Specification sheets accompanying these drawings, 15¢ per page
   Postage and Handling - $8.50 per partial order

CONTRACT DOCUMENTS will be on file and may be examined at the following locations:

Jones Gillam Renz Architects, 730 North 9th Street, Salina, KS 67401, ph. 785-827-0386, www.jgrarchitects.com
Associated General Contractors of Kansas, ph. 316-928-8635, www.agcks.org
Dodge Construction Network, ph. 877-784-9556, www.construction.com
Construct Connect, ph. 877-969-2909, www.cmdgroup.com
Salina Blueprint, 209 S. Santa Fe Ave., Salina, KS 67401, ph. 785-827-6182, www.salinablue.com
Salina Area Chamber of Commerce Plan Room, 120 West Ash, Salina, KS 67401, ph. 785-827-9301, www.salinakansas.org

7. BID SECURITY in the amount of 5% of the bid must accompany each bid in accordance with INFORMATION FOR BIDDERS.

BY ORDER OF:
Clyde Community Hall Inc.
April 17, 2026

INFORMATION FOR BIDDERS

1. Receipt and Opening of Bids

Clyde Community Hall, Inc. (herein called "Owner"), invites bids on the form attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Owner at the office of The Clyde Community Hall, 4001 Washington Street, Clyde, Kansas until 2 : 0 0 o'clock P.M. Wednesday, May 27th 20 2 6 , and then at said office publicly opened and read aloud. The envelopes containing the bids must be sealed, addressed to Clyde Community Hall, Inc, PO Box 44 at Clyde, Kansas 66938 and designated as bid for Clyde Community Hall - Renovation . The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within 30 days after the actual date of the opening thereof.

2. Preparation of Bid: Each bid must be submitted on the prescribed form and accompanied by Certification by Bidder Regarding Equal Employment Opportunity, Form HUD-950.1, Certification by Bidder (Contractor) concerning Labor Standards and Prevailing Wage Requirements, Form HUD-1422, and Certification of Bidder Regarding Section 3 and Segregated Facilities. All blank spaces for bid prices must be filled in, in ink or typewritten, in both words and figures, and the foregoing Certifications must be fully completed and executed when submitted.

3. Subcontracts: The bidder is specifically advised that any person, for, or other party to whom it is proposed to award a subcontract under this contract:

   a. Must be acceptable to the owner after verification by the Kansas Department of Commerce office of the current eligibility status; and,

   b. Approval of the proposed subcontract award cannot be given by the Owner unless and until the proposed subcontractor has submitted the Certifications and/or other evidence showing that it has fully complied with any reporting requirements to which it is or was subject. Although the bidder is not required to attach such Certifications by proposed subcontractors to his/her bid, the bidder is here advised of this requirement so that appropriate action can be taken to prevent subsequent delay in subcontract awards.

4. Telegraphic Modification: Any bidder may modify his/her bid by telegraphic communication at any time prior to the scheduled closing time for receipt of bids, provided such telegraphic communication is received by the Owner prior to the closing time, and provided further, the Owner is satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the closing time. The telegraphic communication should not reveal the bid price but should provide the addition or subtraction or other modification so that the final prices or terms will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two days from the closing time, no consideration will be given to the telegraphic modification.

5. Method of Bidding: The Owner invites the following bid(s):
Bids are preferred to be submitted on the forms provided. All blank spaces on the forms shall be fully completed in words as well as figures. Bid Forms must be signed in longhand, with name typed below signature. Where Bidder is a corporation, Bid Forms must be signed with legal name of corporation, followed by the name of the State of Incorporation, the legal signature of an officer authorized to bind the corporation to a contract, Attest and Seal Impression.

Submittals of Bids shall be as follows:

a. Bids, together with Bid Security, shall be sealed in an opaque envelope, labeled "CLYDE COMMUNITY HALL - RENOVATION, SEALED BID, DO NOT OPEN" addressed to: CLYDE COMMUNITY HALL INC, ATTN: BRAD BLACKWOOD – BOARD CHAIR, PO BOX 44, CLYDE KANSAS 66938

b. If the Bid is mailed, the above shall be addressed to: CYLDE COMMUNITY HALL INC, ATTN: BRAD BLACKWOOD – BOARD CHAIR, PO BOX 44, CLYDE KANSAS 66938.

6. Qualifications of Bidder: The Owner may make such investigations as she/he deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.

7. Bid Security: Each bid must be accompanied by cash, certified check of the bidder, or a bid bond prepared on the form of bid bond attached hereto, duly executed by the bidder as principal and having as surety thereon a surety company approved by the Owner, in the amount of 5% of the bid. Such cash, checks or bid bonds will be returned to all except the three lowest bidders within three days after the opening of bids, and the remaining cash, checks or bid bonds will be returned promptly after the Owner and the accepted bidder have executed the contract, or, if no award demand of the bidder at any time thereafter, so long as she/he has not been notified of the acceptance of his/her bid.

8. Liquidated Damages for Failure to Enter into Contract: The successful bidder, upon his/her failure or refusal to execute and deliver the contract and bonds required within 10 days after she/he received notice of the acceptance of his/her bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his/her bid.

9. Time of Construction and Penalty Clause
Refer to Section 01019 – Special Provisions.

10. Conditions of Work: Each bidder must inform him/herself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his/her obligation to furnish all material and labor necessary to carry out the provisions of his/her contract. Insofar as possible the contractor, in carrying out the work, must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.

11. Questions And Interpretation Of Documents
Should a Bidder be in doubt as to the meaning of any part of the Drawings, Specifications or other proposed Contract Documents and/or find discrepancies in or omissions from the Drawings, Specifications and Contract Documents, they shall contact the Architect immediately. Any interpretation of the proposed documents will be made only by Addendum duly issued and copy of such Addendum will be emailed to each person receiving a set of such documents. The Architect and Owner will not be responsible for any other explanation or interpretation of the proposed documents.

12. Security for Faithful Performance: Simultaneously with his/her delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner.

13. Power of Attorney: Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

14. Notice of Special Conditions: Attention is particularly called to those parts of the contract documents and specifications which deal with the following:

a. Inspection and testing of materials.
b. Insurance requirements.
c. Wage rates.
d. Stated allowances.

15. Laws and Regulations: The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full.

16. Method of Award – Lowest Qualified Bidder: If at the time this contract is to be awarded, the lowest base bid submitted by a responsible bidder does not exceed the amount of funds then estimated by the Owner as available to finance the contract, the contract will be awarded on the base bid only. If such bid exceeds such amount, the Owner may reject all bids or may award the contract on the base bid combined with such deductible alternates applied in numerical order in which they are listed in the Form of Bid, as produces a net amount which is within the available funds.

17. Obligation of Bidder: At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect of his/her bid.

18. Safety Standards and Accident Prevention: With respect to all work performed under this contract, the contractor shall:

    a. Comply with the safety standards provisions of applicable laws, building and construction codes and the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970 (Public Law 91-596), and the requirements of Title 29 of the Code of Federal Regulations, Section 1518 as published in the "Federal Register", Volume 36, No. 75, Saturday, April 17, 1971.

    b. Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.

    c. Maintain at his/her office or other well known place at the job site, all articles necessary for giving first aid to the injured, and shall make arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees), who may be injured on the job site. In no case shall employees be permitted to work at a job site before the employer has made a standing arrangement for removal of injured persons to a hospital or a doctor's care.

19. Projects funded through the CDBG Program are subject to Davis-Bacon Act Regulations. Contractors are required to pay prevailing wage rates to all laborers and mechanics employed on CDBG funded projects.

Clyde Community Hall - Renovation
Clyde, KS
BID FORM

Bid of _____
(Firm Name)

Date _____

BID FORM FOR:

Clyde Community Hall – Renovation
Clyde Kansas
Project No. 25-3508

In compliance with your INVITATION TO BID, the undersigned proposes to furnish all labor and materials and perform all work for the General Construction, including Mechanical and Electrical Work, incidental for the construction and equipping of **Clyde Community Hall – Renovations, Clyde Kansas**, in strict accordance with the Specifications and Drawings dated April 16, 2026 for consideration of the following:

BASE BID _____ **DOLLARS**

$ _____

The Base Bid includes all allowances as outlined in Section 01019 – Special Provisions.

Number of consecutive Calendar Days to complete this project in accordance with Drawings and Specifications, to be coordinated with General Contractor and subject to Liquidated Damages,

Section 01019 - SPECIAL PROVISIONS -- _____ **DAYS**

The Undersigned acknowledges receipt of the following addenda:

Addendum #1 ____ Addendum #2 _____ Addendum #3 _____ Addendum #4 _____ Addendum #5 _____

ALTERNATE PRICES: For the Alternates as described in the Specifications and/or Drawings, the UNDERSIGNED agrees to ADD or DEDUCT the following amounts to or from the BASE BID as hereinafter itemized:

Alternate No.	**Add**	**Deduct**
Alternate No. 1 New Interior Stair and Elevator Shaft	$ _____	$ _____
Alternate No. 2 Install Concrete Floor Slab at Basement #B2	$ _____	$ _____
Alternate No. 3 Delete False Ceiling Beams and Wall Columns	$ _____	$ _____
Alternate No. 4 Stain Designated Exterior Brick	$ _____	$ _____
Alternate No. 5 Delete Fire Sprinkler System (except main service line into building)	$ _____	$ _____
Alternate No. 6 Delete Main Service Sprinkler Line in Bldg.	$ _____	$ _____
Alternate No. 7 Delete Fire Alarm System	$ _____	$ _____

Alternate No.	Add	Deduct
Alternate No. 8 Delete Interior Wainscot (keep chair rail and base)	$ _____	$ _____
Alternate No. 9 Delete Ceramic Wall Tile in Restrooms	$ _____	$ _____
Alternate No. 10 Delete Epoxy Resin Floor System at Restrooms	$ _____	$ _____
Alternate No. 11 Delete Raised Panel Doors. (Flat Panel instead)	$ _____	$ _____
Alternate No. 12 Provide Single Phase Main Service in lieu of 3-phase and all associated equipment adjustments.	$ _____	$ _____
Alternate No. 13 (As described by Addendum)	$ _____	$ _____
Alternate No. 14 (As described by Addendum)	$ _____	$ _____

I (or WE) FURTHER AGREE AS FOLLOWS:

1. To furnish labor and materials for additional work (except Mechanical and Electrical) ordered by the Owner and for which no pre-agreed upon amount has been determined for the cost of the labor and materials involved plus 10% for overhead and profit.
2. To furnish supervision and coordination for 10% of the cost of additional Mechanical and Electrical work ordered by the Owner.
3. To accept the provisions of Section 01019 – SPECIAL PROVISIONS regarding the date of completion of the Project and Penalty Clause.
4. If written notice of the acceptance of the Bid is mailed, telegraphed or delivered to the Undersigned within 60 days after the date of the opening of the Bids, or anytime thereafter before this Bid is withdrawn, the Undersigned will, within ten (10) days after the date of such mailing, telegraphing or delivery of such notice, execute and deliver a contract in accordance with AIA Document A101, Standard Form of Agreement Between Owner and Contractor, and give Performance Bond in accordance with the Specifications and bid as accepted.
5. That upon failure or refusal to execute and deliver the contract and bonds required within ten (10) days after receipt of notice of acceptance of the Bid, that security deposited with Bid shall be forfeited to the Owner as liquidated damages for such failure or refusal.

DECLARATION:

1. The Undersigned hereby declares that he has carefully examined the Invitation and Information for Bidders, the Drawings and Specifications, has visited the actual location of the Work and has consulted his sources of supply, and has satisfied himself as to all quantities and conditions, and understands that in signing this Bid, he waives all rights to plead any misunderstanding regarding the same.

2. The Undersigned understands that his competence and responsibility and that of his proposed subcontractors, time of completion, as well as any other factors of interest to the Owner will be considered in making the award. The Owner reserves the right to reject any or all bids, to accept or reject alternate bids and unit prices and to waive technicalities concerning the bids received, as it may be in his interest to do so.

_____
(Legal Name of Bidder)

(SEAL, if bid is by a corporation)

_____
(Address of Bidder)

BY _____ in longhand

_____ Typewritten
(Title)

Kansas Small Cities CDBG
BABA Language for Inclusion in Bids and Subcontracts

When advertising for a bid, language for BABA should be included. The language is exampled below.

Minimum Language for All Contracts Provided by HUD:

> The Grantee must comply with the requirements of the Build America, Buy America (BABA) Act, 41 USC 8301 note, and all applicable rules and notices, as may be amended, if applicable to the Grantee's infrastructure project. Pursuant to HUD's Notice, "Public Interest Phased Implementation Waiver for FY 2022 and 2023 of Build America, Buy America Provisions as Applied to Recipients of HUD Federal Financial Assistance" (88 FR 17001), any funds obligated by HUD on or after the applicable listed effective dates, are subject to BABA requirements, unless excepted by a waiver.

Sample Language for Inclusion into Professional Services Agreements:

> This agreement is for professional services related to a project that is subject to the Build America, Buy America Act (BABA) requirements under Title IX of the Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. 177-58. While professional services are not subject to BABA, the Provider understands that they are responsible for ensuring that, absent a waiver by the Department of Housing and Urban Development, Provider shall not approve for use in this project, any iron, steel, manufactured products, or construction materials unless such materials have been produced in the United States. Provider shall obtain all necessary compliance certificates for work that is within provider's scope of work. Failure to do so shall be a default under this agreement. Guidance on complying with BABA is outlined by Office of Management and Budget's Memorandum M-24-02, Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure.

Sample Language for Inclusion into Advertisement for Bids:

> This agreement is for services related to a project that is subject to the Build America, Buy America (BABA) Act, 41 USC 8301 note, and all applicable rules and notices, as may be amended. Absent an approved waiver, all iron, steel, manufactured products, and construction materials used in this project must be produced in the United States, as further outlined by the Office of Management and Budget's Memorandum M-24-02, "Implementation Guidance on Application of Buy America Preference in Federal Financial Assistance Programs for Infrastructure."
>
> Contractor shall include Manufacturer's Certification for BABA requirements for all BABA-covered items to be incorporated into the infrastructure project. Contractor shall comply with BABA requirements, including coordination with manufacturers, distributors, and suppliers to correct deficiencies in any BABA documentation. For any change orders, Contractor shall provide BABA documentation for any new products or materials required by the change. Contractor shall designate the responsible parties for determining the final categorizations for all project items.

BUILD AMERICA, BUY AMERICA
CERTIFICATE OF COMPLIANCE

This signed statement is used to certify that, as required by the Build America, Buy America (BABA) Act, all of the iron, steel, manufactured products, and construction materials incorporated into this CDBG-funded rehabilitation, maintenance, reconstruction, construction, or repair project are produced in the United States, unless exempted by a HUD general waiver or a project-/product-specific waiver approved by the Made in America Office (MIAO) at the Office of Management and Budget (OMB).

Grantee Name: _____ **Project Number**:_____

For covered materials not otherwise exempted from the BAP. the undersigned certifies the following:

- All iron and steel used in the project are produced in the United States. This means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;

- All manufactured products used in the project are produced in the United States. This means the manufactured product was manufactured in the United States, and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard that meets or exceeds this standard has been established under applicable law or regulation for determining the minimum amount of domestic content of the manufactured product;

- All construction materials used in the project are manufactured in the United States. This means that all manufacturing processes for the construction material occurred in the United States.

Attach a list of all covered materials procured by the signatory and used in the project.

I hereby certify this information is complete and accurate and agree to provide documentation collected on the country of origin for all covered materials I caused to be incorporated into or affixed to this project to the CDBG grantee and Kansas Department of Commerce upon request. I hereby certify that all bidding documents, procurement documents, and any other design deliverables comply with all applicable federal requirements including the BABA preference requirements mandated by the Infrastructure Investment and Jobs Act of 2021 or are the subject of a waiver approved by the designee.

General Contractor Signature: _____ **Date**:_____

Name/Title/Company: _____

KDC Small Cities CDBG
BUILD AMERICA, BUY AMERICA ACT
MANUFACTURER CERTIFICATION LETTER TEMPLATE

The following information is provided as an example letter template of a manufacturer's certification for BABA compliance. The grantee should keep this letter in the project files and admins should note each certification on the Project Items BABA Status Worksheet throughout the project. The letter must be provided on the manufacturing company's letterhead and included with construction drawdowns for applicable products. Include attachments as necessary.

Manufacturer logo

Date
Company Name
Company Address
City, State Zip

Subject: Build America, Buy America Certification for Project *(project name and location of project)*

I, *(company representative)*, certify that the following products and/or materials shipped/provided to the above-referenced project are in full compliance with the Build America, Buy America (BABA) requirement as mandated by U.S. Department of Housing and Urban Development (HUD).

Item, Products and/or Materials and relevant Product Service Code (PSC) and North American Industry Classification System (NAICS) code:
1. *Xxxx*
2. *Xxxx*
3. *Xxxx*

Such process took place at the following location:

If any of the above compliance statements change while providing material to this project, we will immediately notify the general contractor and the engineer/architect.

Signed by company representative.
Printed name of company representation.
Professional title of company representative
Email address:
Phone number:

"General Decision Number: KS20260044 01/02/2026

Superseded General Decision Number: KS20250044

State: Kansas

Construction Type: Building

Counties: Allen, Anderson, Atchison, Barber, Barton, Bourbon, Brown, Chautauqua, Cherokee, Cheyenne, Clark, Clay, Cloud, Coffey, Comanche, Cowley, Crawford, Decatur, Dickinson, Edwards, Elk, Ellsworth, Ford, Gove, Graham, Grant, Gray, Greenwood, Hamilton, Harper, Haskell, Hodgeman, Jewell, Kingman, Kiowa, Labette, Lane, Lincoln, Logan, Marion, Marshall, McPherson, Meade, Mitchell, Morris, Morton, Nemaha, Neosho, Ness, Osborne, Pawnee, Phillips, Pratt, Rawlins, Republic, Rooks, Rush, Russell, Sheridan, Sherman, Smith, Stafford, Stanton, Stevens, Thomas, Trego, Wallace, Washington, Wichita, Wilson and Woodson Counties in Kansas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Modification Number	Publication Date
0	01/02/2026

ASBE0027-002 10/07/2024

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 43.60	33.52

BRKS0015-015 05/01/2025

	Rates	Fringes
BRICKLAYER	$ 29.07	15.61

ELEV0012-004 01/01/2025

	Rates	Fringes
ELEVATOR MECHANIC	$ 60.69	38.435+a+b

a. VACATION PAY: 6% for 6 months to 5 years service; 8% with 5 or more years of service.

b. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and Friday after, and Christmas Day.

IRON0010-031 04/01/2025

	Rates	Fringes
IRONWORKER, REINFORCING	$ 39.00	34.25

PAIN2012-007 04/01/2025

	Rates	Fringes

PAINTER (Brush and Roller).....$ 36.18 19.97

PLUM0441-015 06/30/2025

	Rates	Fringes
PIPEFITTER (Excludes HVAC Pipe and Unit Installation).....	$ 45.90	19.94

PLUM0441-016 06/30/2025

	Rates	Fringes
PIPEFITTER (HVAC Pipe Installation Only).....	$ 45.90	19.94

SFKS0669-002 04/01/2025

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinkler).....	$ 41.83	27.60

SHEE0002-016 07/01/2024

	Rates	Fringes
SHEET METAL WORKER (Excludes HVAC Duct and Unit Installation).....	$ 52.18	27.15

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* UAVG-KS-0001 01/01/2025

	Rates	Fringes
ELECTRICIAN (HVAC/Temperature Controls Installation Only).....	$ 38.75	18.52

SUKS2015-013 07/08/2015

	Rates	Fringes
CARPENTER (Drywall Hanging Only).....	$ 17.92	2.09
CARPENTER, Excludes Drywall Hanging, and Form Work.....	$ 19.04	3.95
CEMENT MASON/CONCRETE FINISHER...	$ 18.01	3.33
ELECTRICIAN, Excludes Installation of HVAC/Temperature Controls.....	$ 27.63	10.96
FORM WORKER.....	$ 13.33	0.00
GLAZIER.....	$ 18.92	6.64
IRONWORKER, STRUCTURAL.....	$ 23.02	15.09
LABORER: Common or General.....	$ 12.37	2.77
METAL BUILDING ERECTOR.....	$ 11.19	1.83

OPERATOR:
Backhoe/Excavator/Trackhoe.....$ 15.72 1.95

PLUMBER, Excludes HVAC Pipe
and Unit Installation.....$ 27.79 10.85

ROOFER.....$ 14.48 2.96

SHEET METAL WORKER (HVAC Duct
Installation Only).....$ 23.18 5.83

SHEET METAL WORKER (HVAC Unit
Installation Only).....$ 28.20 10.85

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the

type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the

interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION
"

A. APPLICABILITY

The Project or Program to which the construction work covered by this Contract pertains is being assisted by the United States of America, and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

1. Minimum wages and fringe benefits

i. All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in 29 CFR 5.5(d) and (e), the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(v) of these contract clauses; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under 29 CFR 5.5(a)(1)(iii)) and the Davis-Bacon poster (WH-1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

ii. Frequently recurring classifications

A. In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to 29 CFR 5.5(a)(1)(iii), provided that:

1. The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

2. The classification is used in the area by the construction industry; and

3. The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

B. The Administrator will establish wage rates for such classifications in accordance with 29 CFR 5.5(a)(1)(iii)(A)(3). Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

iii. Conformance

A. The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be

classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

1. The work to be performed by the classification requested is not performed by a classification in the wage determination; and
2. The classification is used in the area by the construction industry; and
3. The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

B. The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

C. If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to DBAconformance@dol.gov. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

D. In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to DBAconformance@dol.gov, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

E. The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under 29 CFR 5.5 (a)(1)(iii)(C) and (D). The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to 29 CFR 5.5 (a)(1)(iii)(C) or (D) must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

iv. Fringe benefits not expressed as an hourly rate

Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

v. Unfunded plans

If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in 29 CFR 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

vi. Interest In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding

i. Withholding requirements

The U. S. Department of Housing and Urban Development may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in 29 CFR 5.5(a) for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in 29 CFR 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work (or otherwise working in construction or development of the project under a development statute) all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in 29 CFR 5.5(a)(3)(iv), HUD may on its own initiative and after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

ii. Priority to withheld funds

The Department has priority to funds withheld or to be withheld in accordance with 29 CFR 5.5(a)(2)(i) or (b)(3)(i), or both, over claims to those funds by:

- **A.** A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;
- **B.** A contracting agency for its reprocurement costs;
- **C.** A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;
- **D.** A contractor's assignee(s);
- **E.** A contractor's successor(s); or
- **F.** A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901-3907.

3. Records and certified payrolls

i. Basic record requirements

- **A. Length of record retention.** All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.
- **B. Information required** Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.
- **C. Additional records relating to fringe benefits***.* Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(v) that the wages of any laborer or mechanic include the amount of any

costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

D. Additional records relating to apprenticeship Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

ii. Certified payroll requirements

A. Frequency and method of submission The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to HUD if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the certified payrolls to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to HUD. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system

B. Information required The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i)(B), except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.*, the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH-347 or in any other format desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the sponsoring government agency (or the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records).

C. Statement of Compliance Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

1. That the certified payroll for the payroll period contains the information required to be provided under 29 CFR 5.5(a)(3)(ii), the appropriate information and basic records are being maintained under 29 CFR 5.5 (a)(3)(i), and such information and records are correct and complete;

2. That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly

from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

3. That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

D. Use of Optional Form WH-347 The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 will satisfy the requirement for submission of the "Statement of Compliance" required by 29 CFR 5.5(a)(3)(ii)(C).

E. Signature The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

F. Falsification The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

G. Length of certified payroll retention The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

iii. Contracts, subcontracts, and related documents The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

iv Required disclosures and access

A. Required record disclosures and access to workers The contractor or subcontractor must make the records required under 29 CFR 5.5(a)(3)(i)–(iii), and any other documents that HUD or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by 29 CFR 5.1, available for inspection, copying, or transcription by authorized representatives of HUD or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

B. Sanctions for non-compliance with records and worker access requirements If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to 29 CFR 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

C. Required information disclosures Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to HUD if the agency is a party to

the contract, or to the Wage and Hour Division of the Department of Labor. If the Federal agency is not such a party to the contract, the contractor, subcontractor, or both, must, upon request, provide the full Social Security number and last known address, telephone number, and email address of each covered worker to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to HUD, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity

i. Apprentices

A. Rate of pay Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

B. Fringe benefits Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

C. Apprenticeship ratio The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to 29 CFR 5.5(a)(4)(i)(D). Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in 29 CFR 5.5(a)(4)(i)(A), must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

D. Reciprocity of ratios and wage rates Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

ii Equal employment opportunity The use of apprentices and journeyworkers under this part must be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

5 Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6 Subcontracts. The contractor or subcontractor must insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (11), along with the applicable wage determination(s) and such other clauses or contract modifications as the U.S. Department of Housing and
Urban Development may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate.

7 Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8 Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9 Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

i. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or 29 CFR 5.12(a).

ii. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or 29 CFR 5.12(a).

iii. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

11 Anti-retaliation It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

- **i.** Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, or 29 CFR parts 1, 3, or 5;
- **ii.** Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, or 29 CFR parts 1, 3, or 5;
- **iii.** Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, or 29 CFR parts 1, 3, or 5; or
- **iv.** Informing any other person about their rights under the DBA, Related Acts, or 29 CFR parts 1, 3, or 5.

B. Contract Work Hours and Safety Standards Act (CWHSSA)

The Agency Head must cause or require the contracting officer to insert the following clauses set forth in 29 CFR 5.5(b)(1), (2), (3), (4), and (5) in full, or (for contracts covered by the Federal Acquisition Regulation) by reference, in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses must

be inserted in addition to the clauses required by 29 CFR 5.5(a) or 4.6. As used in this paragraph, the terms "laborers and mechanics" include watchpersons and guards.

1. **Overtime requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
2. **Violation; liability for unpaid wages; liquidated damages.** In the event of any violation of the clause set forth in 29 CFR 5.5(b)(1) the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in 29 CFR 5.5(b)(1), in the sum of $31 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in 29 CFR 5.5(b)(1).
3. **Withholding for unpaid wages and liquidated damages**

i. **Withholding process** The U.S Department of Housing and Urban Development or the recipient of Federal assistance may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in 29 CFR 5.5(b) on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in 29 CFR 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

ii **Priority to withheld funds** The Department has priority to funds withheld or to be withheld in accordance with 29 CFR 5.5(a)(2)(i) or (b)(3)(i), or both, over claims to those funds by:

- **A.** A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;
- **B.** A contracting agency for its reprocurement costs;
- **C.** A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;
- **D.** A contractor's assignee(s);
- **E.** A contractor's successor(s); or
- **F.** A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901-3907.

4. ***Subcontracts***. The contractor or subcontractor must insert in any subcontracts the clauses set forth in 29 CFR 5.5(b)(1) through (5) and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in 29 CFR 5.5(b)(1) through (5). In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss,

due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5 Anti-retaliation It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

- **i.** Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in 29 CFR part 5;
- **ii.** Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or 29 CFR part 5;
- **iii.** Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or 29 CFR part 5; or
- **iv.** Informing any other person about their rights under CWHSSA or 29 CFR part 5.

C. CWHSSA required records clause In addition to the clauses contained in 29 CFR 5.5(b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other laws referenced by 29 CFR 5.1, the Agency Head must cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor must maintain regular payrolls and other basic records during the course of the work and must preserve them for a period of 3 years after all the work on the prime contract is completed for all laborers and mechanics, including guards and watchpersons, working on the contract. Such records must contain the name; last known address, telephone number, and email address; and social security number of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid; daily and weekly number of hours actually worked; deductions made and actual wages paid. Further, the Agency Head must cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph must be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview workers during working hours on the job.

D. Incorporation of contract clauses and wage determinations by reference Although agencies are required to insert the contract clauses set forth in this section, along with appropriate wage determinations, in full into covered contracts, and contractors and subcontractors are required to insert them in any lower-tier subcontracts, the incorporation by reference of the required contract clauses and appropriate wage determinations will be given the same force and effect as if they were inserted in full text.

E. Incorporation by operation of law The contract clauses set forth in this section (or their equivalent under the Federal Acquisition Regulation), along with the correct wage determinations, will be considered to be a part of every prime contract required by the applicable statutes referenced by 29 CFR 5.1 to include such clauses, and will be effective by operation of law, whether or not they are included or incorporated by reference into such contract, unless the Administrator grants a variance, tolerance, or exemption from the application of this paragraph. Where the clauses and applicable wage determinations are effective by operation of law under this paragraph, the prime contractor must be compensated for any resulting increase in wages in accordance with applicable law.

F. HEALTH AND SAFETY

The provisions of this paragraph (F) are applicable where the amount of the prime contract exceeds **$100,000**.

1. No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his or her health and safety, as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.
2. The contractor shall comply with all regulations issued by the Secretary of Labor pursuant to 29 CFR Part 1926 and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act, (Public Law 91-54, 83 Stat 96), 40 U.S.C. § 3701 et seq.
3. The contractor shall include the provisions of this paragraph in every subcontract, so that such provisions will be binding on each subcontractor. The contractor shall take such action with respect to any subcontractor as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

U.S. Department of Labor
Wage and Hour Division

Davis-Bacon and Related Acts Weekly Certified Payroll Form

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Unless otherwise noted, the information requested is specific to the named project below.

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. January 2025
OMB No.: 1235-0008
Expires: 01/31/2028

☐ SUBMISSION OF FINAL DBRA CERTIFIED PAYROLL FORM ☐ PRIME CONTRACTOR ☐ SUBCONTRACTOR

PROJECT NAME	PROJECT NO. or CONTRACT NO.	CERTIFIED PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME
PROJECT LOCATION	**WAGE DETERMINATION NO.**	**WEEK ENDING DATE**	**PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS ADDRESS**

(1A)	(1B)	(1C)	(1D)	(1E)	(2)	(3)		(4)								(5)	(6A)	(6B)	(6C)	(7A)	(7B)	(8)				(9)
WORKER ENTRY NO.	WORKER LAST NAME	WORKER FIRST NAME	WORKER MIDDLE INITIAL	WORKER IDENTIFYING NO.	(J) JOURNEYWORKER (RA) REGISTERD APPRENTICE	LABOR CLASSIFICATION		ST = STRAIGHT TIME OT = OVERTIME	(TOP) DAYS OF WORK WEEK (BOTTOM) DATES							TOTAL HOURS WORKED FOR WEEK	HOURLY WAGE RATE PAID FOR ST AND OT	TOTAL FRINGE BENEFIT CREDIT	PAYMENT IN LIEU OF FRINGE BENEFITS	GROSS AMT EARNED	GROSS AMT EARNED FOR **ALL WORK**	DEDUCTIONS FOR **ALL WORK**				NET PAY TO WORKER FOR **ALL WORK**
																						TAX WITH-HOLDINGS	FICA	OTHER (MUST SPECIFY, SEE INSTRUCTIONS)	TOTAL DEDUCTIONS	
								HOURS WORKED EACH DAY																		
							ST																			
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While use of Form WH-347 itself is optional, covered contractors and subcontractors performing work on Federal or federally assisted construction contracts are required by the DBRA regulations and the contract clauses to submit payroll information on a weekly basis. The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federal or federally financed construction contracts to, on a weekly basis, "furnish a statement on the wages paid each employee during the prior week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors and subcontractors to submit weekly certified payrolls to the appropriate Federal agency if the agency is a party to the contract (or, if the agency is not such a party, to the applicant, sponsor, owner, or other entity, as the case may be, that maintains such records, for transmission to the Federal agency). Each certified payroll must be accompanied by a signed "Statement of Compliance" (e.g., page 2 of the WH-347 or another document with identical wording) indicating that the certified payrolls are accurate and complete, and that each laborer or mechanic has been paid not less than the required Davis-Bacon prevailing wage rate(s) (including any fringe benefits) for the work performed. DOL and contracting agencies receiving this information review the information to determine whether workers have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

(over)

PROJECT NAME	PROJECT NO. or CONTRACT NO.	PAYROLL NO.	PRIME CONTRACTOR'S/SUBCONTRACTOR'S BUSINESS NAME
PROJECT LOCATION		**WEEK ENDING DATE**	**CERTIFYING OFFICIAL's NAME AND TITLE**

I paid or supervised the payment of the laborers or mechanics working on the above project during the stated time period. I certify the following:

☐ The payroll information submitted with this statement is correct and complete for the above project during the above period, and the wage and fringe benefit rates paid to the workers, including credit taken for the reasonably anticipated costs of a bona fide fringe benefit plan, fund or program, are not less than the applicable wage and fringe benefits rates for the classification(s) of work actually performed, as specified in the wage determination(s) incorporated into the contract.

☐ All regular payrolls and all other basic records that the contractor is required to maintain for this payroll period are complete and accurate and will be made available upon request from the agency or the Department of Labor.

☐ The classifications reported for each laborer or mechanic are the classification(s) of work that each worker actually performed.

☐ Any workers paid as apprentices during the above period are duly registered in a bona fide apprenticeship program registered with the Office of Apprenticeship, Employment and Training Administration, United States Department of Labor ("OA"), or a State Apprenticeship Agency ("SAA") recognized by Department of Labor. I have verified the registered apprenticeship program information provided below as accurate and applicable to any apprentices identified on page 1 of this form.

APPRENTICESHIP PROGRAM NAME	REGISTERED		NAME OF LABOR CLASSIFICATION
	☐ OA	☐ SAA	
	☐ OA	☐ SAA	
	☐ OA	☐ SAA	

☐ Fringe benefits have been paid in cash and/or to bona fide fringe benefit plans, funds, or programs. Where the contractor is claiming an hourly credit for their contributions to or reasonably anticipated costs of a bona fide fringe benefit plan, fund, or program, provide plan information and the hourly credit claimed for each worker listed on the previous page of this form.

HOURLY CREDIT FOR FRINGE BENEFITS

If an amount is listed in (6B) on the first page of this certified payroll form, enter the hourly credit claimed under each plan name, type and number for each worker and check whether the plan is funded or unfunded.

NAME OF WORKER	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	FB NAME / FB TYPE / PLAN NO. / ☐ Funded ☐ Unfunded	TOTAL HOURLY CREDIT
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	$
	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hourly Credit $	Hrly Credit $	$

☐ All workers on the project have been paid the full weekly wages earned, and no rebates or deductions have been or will be made either directly or indirectly, other than permissible deductions as defined in 29 CFR part 3.

ADDITIONAL REMARKS

SIGNATURE OF CERTIFYING OFFICIAL	DATE	TELEPHONE NUMBER	EMAIL ADDRESS
		(___) ___-____	

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION (SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF TITLE 31 OF THE UNITED STATES CODE), AS WELL AS DEBARMENT FROM FUTURE FEDERAL AND FEDERALLY-ASSISTED CONTRACTS. INFORMATION REPORTED IN CERTIFIED PAYROLLS MAY BE SUBJECT TO DISCLOSURE IN RESPONSE TO A FREEDOM OF INFORMATION ACT REQUEST.

Department of Labor: Wage and Hour Division (WHD)
Instructions For Completing Payroll Form, WH-347
OMB Control No. 1235-0008, Expires 07/31/2024

General: Form WH-347 has been made available for the convenience of contractors and subcontractors required by their Federal or Federally-aided construction-type contracts and subcontracts to submit weekly payrolls. Properly filled out, this form will satisfy the requirements of Regulations, Parts 3 and 5 (29 C.F.R., Subtitle A), as to payrolls submitted in connection with contracts subject to the Davis-Bacon and related Acts.

While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Under the Davis-Bacon and related Acts, the contractor is required to pay not less than prevailing wage, including fringe benefits, as predetermined by the Department of Labor. The contractor's obligation to pay fringe benefits may be met either by payment of the fringe benefits to bona fide benefit plans, funds or programs or by making payments to the covered workers (laborers and mechanics) as cash in lieu of fringe benefits.

This payroll provides for the contractor to show on the face of the payroll all monies to each worker, whether as basic rates or as cash in lieu of fringe benefits, and provides for the contractor's representation in the statement of compliance on the payroll (as shown on page 2) that he/she is paying for fringe benefits required by the contract and not paid as cash in lieu of fringe benefits. Detailed instructions concerning the preparation of the payroll follow:

Contractor or Subcontractor: Fill in your firm's name and check appropriate box.

Address: Fill in your firm's address.

Payroll No.: Beginning with the number "1", list the payroll number for the submission.

For Week Ending: List the workweek ending date.

Project and Location: Self-explanatory.

Project or Contract No.: Self-explanatory.

Column 1 - Name and Individual Identifying Number of Worker: Enter each worker's full name and an individual identifying number (e.g., last four digits of worker's social security number) on each weekly payroll submitted.

Column 2 - No. of Withholding Exemptions: This column is merely inserted for the employer's convenience and is not a requirement of Regulations, Part 3 and 5.

Column 3 - Work Classifications: List classification descriptive of work actually performed by each laborer or mechanic. Consult classification and minimum wage schedule set forth in contract specifications. If additional classifications are deemed necessary, see Contracting Officer or Agency representative. An individual may be shown as having worked in more than one classification provided an accurate breakdown or hours worked in each classification is maintained and shown on the submitted payroll by use of separate entries.

Column 4 - Hours worked: List the day and date and straight time and overtime hours worked in the applicable boxes. On all contracts subject to the Contract Work Hours Standard Act, enter hours worked in excess of 40 hours a week as "overtime".

Column 5 - Total: Self-explanatory

Column 6 - Rate of Pay (Including Fringe Benefits): In the "straight time" box for each worker, list the actual hourly rate paid for straight time worked, plus cash paid in lieu of fringe benefits paid. When recording the straight time hourly rate, any cash paid in lieu of fringe benefits may be shown separately from the basic rate. For example, "$12.25/.40" would reflect a $12.25 base hourly rate plus $0.40 for fringe benefits. This is of assistance in correctly computing overtime. See "Fringe Benefits" below. When overtime is worked, show the overtime hourly rate paid plus any cash in lieu of fringe benefits paid in the "overtime" box for each worker; otherwise, you may skip this box. See "Fringe Benefits" below. Payment of not less than time and one-half the basic or regular rate paid is required for overtime under the Contract Work Hours Standard Act of 1962 if the prime contract exceeds $100,000. In addition to paying no less than the predetermined rate for the classification which an individual works, the contractor must pay amounts predetermined as fringe benefits in the wage decision made part of the contract to approved fringe benefit plans, funds or programs or shall pay as cash in lieu of fringe benefits. See "FRINGE BENEFITS" below.

Column 7 - Gross Amount Earned: Enter gross amount earned on this project. If part of a worker's weekly wage was earned on projects other than the project described on this payroll, enter in column 7 first the amount earned on the Federal or Federally assisted project and then the gross amount earned during the week on all projects, thus "$163.00/$420.00" would reflect the earnings of a worker who earned $163.00 on a Federally assisted construction project during a week in which $420.00 was earned on all work.

Column 8 - Deductions: Five columns are provided for showing deductions made. If more than five deduction are involved, use the first four columns and show the balance deductions under "Other" column; show actual total under "Total Deductions" column; and in the attachment to the payroll describe the deduction(s) contained in the "Other" column. All deductions must be in accordance with the provisions of the Copeland Act Regulations, 29 C.F.R., Part 3. If an individual worked on other jobs in addition to this project, show actual deductions from his/her weekly gross wage, and indicate that deductions are based on his gross wages.

Column 9 - Net Wages Paid for Week: Self-explanatory.

Totals - Space has been left at the bottom of the columns so that totals may be shown if the contractor so desires.

Statement Required by Regulations, Parts 3 and 5: While the "statement of compliance" need not be notarized, the statement (on page 2 of the payroll form) is subject to the penalties provided by 18 U.S.C. § 1001, namely, a fine, possible imprisonment of not more than 5 years, or both. Accordingly, the party signing this statement should have knowledge of the facts represented as true.

Items 1and 2: Space has been provided between items (1) and (2) of the statement for describing any deductions made. If all deductions made are adequately described in the "Deductions" column above, state "*See* Deductions column in this payroll." *See* "FRINGE BENEFITS" below for instructions concerning filling out paragraph 4 of the statement.

Item 4 FRINGE BENEFITS - Contractors who pay all required fringe benefits: If paying all fringe benefits to approved plans, funds, or programs in amounts not less than were determined in the applicable wage decision of the Secretary of Labor, show the basic cash hourly rate and overtime rate paid to each worker on the face of the payroll and check paragraph 4(a) of the statement on page 2 of the WH-347 payroll form to indicate the payment. Note any exceptions in section 4(c).

Contractors who pay no fringe benefits: If not paying all fringe benefits to approved plans, funds, or programs in amounts of at least those that were determined in the applicable wage decision of the Secretary of Labor, pay any remaining fringe benefit amount to each laborer and mechanic and insert in the "straight time" of the "Rate of Pay"

column of the payroll an amount not less than the predetermined rate for each classification plus the amount of fringe benefits determined for each classification in the application wage decision. Inasmuch as it is not necessary to pay time and a half on cash paid in lieu of fringe benefits, the overtime rate shall be not less than the sum of the basic predetermined rate, plus the half time premium on basic or regular rate, plus the required cash in lieu of fringe benefits at the straight time rate. In addition, check paragraph 4(b) of the statement on page 2 the payroll form to indicate the payment of fringe benefits in cash directly to the workers. Note any exceptions in section 4(c).

Use of Section 4(c), Exceptions
Any contractor who is making payment to approved plans, funds, or programs in amounts less than the wage determination requires is obliged to pay the deficiency directly to the covered worker as cash in lieu of fringe benefits. Enter any exceptions to section 4(a) or 4(b) in section 4(c). Enter in the Exception column the craft, and enter in the Explanation column the hourly amount paid each worker as cash in lieu of fringe benefits and the hourly amount paid to plans, funds, or programs as fringe benefits. The contractor must pay an amount not less than the predetermined rate plus cash in lieu of fringe benefits as shown in section 4(c) to each such individual for all hours worked (unless otherwise provided by applicable wage determination) on the Federal or Federally assisted project. Enter the rate paid and amount of cash paid in lieu of fringe benefits per hour in column 6 on the payroll. See paragraph on "Contractors who pay no fringe benefits" for computation of overtime rate.

Public Burden Statement: We estimate that it will take an average of 55 minutes to complete this collection of information, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection of information, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W.,Washington, D.C. 20210.

Certification of Understanding and Payroll Authorization*

Project Location: _____

Company Name: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Phone Number: _____ Email: _____

This is to certify that the principle(s), and the authorized payroll officer listed below, have read the "Contractor's Guide to Prevailing Wage Requirements for Federally Assisted Construction" and the Federal Labor Standards Provisions (HUD-4010 form) and that both parties understand these requirements.

The following person is designated as the payroll officer for the company and is authorized to sign the Statement of Compliance that will accompany each weekly Certified Payroll Report for the project:

PAYROLL OFFICER: (Individual responsible for signing Statements of Compliance)

_____ _____
Name Title

_____ _____
Signature Date

PRINCIPLE OWNER/GENERAL PARTNER:

_____ _____
Name Title

_____ _____
Signature Date

***If the owner plans to sign the payrolls, disregard this form.**

Record of Employee Interview

U.S. Department of Housing and Urban Development
Office of Davis-Bacon and Labor Standards

OMB Approval No. 2501-0009
(exp. 12/31/2024)

The public reporting burden estimate for this collection of information is 15 minutes per response on average. This includes reviewing instructions, searching existing data sources, gathering, and maintaining the data, and completing the collection of information. This information may not be collected, nor are you required to provide, the information requested unless it displays a currently valid OMB control number. The information collected ensures compliance with the Federal labor standards through recording interviews with construction workers. The information collected assists HUD in compliance monitoring of Federal labor standards. Any information collected is covered by the Privacy Act of 1974 and by 29 CFR 5.6(a)(5). Individuals and agencies collecting this information must maintain these records in a manner that protects the individuals on whom the information is maintained. The information collected herein is voluntary, and any information provided shall be kept confidential, but failure to provide the information collected may delay enforcement of any possible Federal labor standards violations if the information would have identified any. Comments concerning this burden statement, or this collection should be sent to: National Director, Office of Davis-Bacon and Labor Standards, 451 7th Street SW, Room 7108, Washington, DC 20410. When providing comments, please refer to OMB Approval 2501- 0009.

Pursuant to 5 U.S.C. § 552a(e)(3), this Privacy Act Statement serves to inform you of the following concerning the collection of the information on this form.

A. **AUTHORITY:** Collection of the information solicited on this form is authorized by the Davis-Bacon Act as promulgated through Department of Labor Regulations under 29 CFR Part 5.

B. PURPOSE: The primary purpose for soliciting this information is to determine if the wages paid by an employer on a project covered by the Davis-Bacon Act are in compliance with federal labor standards.

C. ROUTINE USES: The information collected ensures compliance with the Federal labor standards through recording interviews with construction workers on topics related to wages paid on the project. The information is reviewed by HUD authorized personnel to ensure compliance with Federal labor standards under the Davis-Bacon Act on covered projects. If violations are found, the information collected is used to conduct enforcement actions to ensure restitution is paid to workers of covered projects are paid proper wages under the Davis-Bacon Act.

D. CONSEQUENCES OF FAILURE TO PROVIDE INFORMATION: The information collection is voluntary. Refusing to give information will not impact your status with your employer or the government. Failure to provide the information will limit the ability of HUD to determine if you were paid proper wages under the Davis-Bacon Act, and will limit the ability for HUD to seek restitution for you in the event a violation is found.

1a. Project Name			2a. Employee Name		
1b. Project Number			2b. Employee Phone Number (including area code)		
1c. Contractor or Subcontractor (Employer)			2c. Employee Home Address & Zip Code		
			2d. Verification of identification? Yes No		
3a. How long on this job?	3b. Last date on this job before today?	3c. No. of hours last day on this job?	4a. Hourly rate of pay?	4b. Fringe Benefits? Vacation Yes No; Medical Yes No; Pension Yes No	4c. Pay stub? Yes No
5. Your job classification(s) (list all) — continue in block 18 if necessary					
6. Your duties — continue in block 18 if necessary					
7. Tools or equipment used — continue in block 18 if necessary					
8. Are you an apprentice or trainee? Yes No			10. Are you paid at least time and ½ for all hours worked in excess of 40 in a week? Yes No		
9. Are you paid for all hours worked? Yes No			11. Have you ever been threatened or coerced into giving up any part of your pay? Yes No		
12a. Employee Signature			12b. Date		
13. Duties observed by the Interviewer (Please be specific.)					
14. Remarks — continue in block 18 if necessary					
15a. Interviewer Name (Please Print)		15b. Signature of Interviewer		15c. Date of Interview	

Payroll Examination

16. Remarks — continue in block 18 if necessary	
17a. Signature of Payroll Examiner	17b. Date

CONFIDENTIAL

Previous editions are obsolete

Form HUD-11 (12/2021)

U.S. Department of Labor

OSHA®
Occupational Safety and Health Administration

Job Safety and Health
IT'S THE LAW!

All workers have the right to:

- A safe workplace.
- Raise a safety or health concern with your employer or OSHA, or report a work-related injury or illness, without being retaliated against.
- Receive information and training on job hazards, including all hazardous substances in your workplace.
- Request a confidential OSHA inspection of your workplace if you believe there are unsafe or unhealthy conditions. You have the right to have a representative contact OSHA on your behalf.
- Participate (or have your representative participate) in an OSHA inspection and speak in private to the inspector.
- File a complaint with OSHA within 30 days (by phone, online or by mail) if you have been retaliated against for using your rights.
- See any OSHA citations issued to your employer.
- Request copies of your medical records, tests that measure hazards in the workplace, and the workplace injury and illness log.

This poster is available free from OSHA.

Employers must:

- Provide employees a workplace free from recognized hazards. It is illegal to retaliate against an employee for using any of their rights under the law, including raising a health and safety concern with you or with OSHA, or reporting a work-related injury or illness.
- Comply with all applicable OSHA standards.
- Notify OSHA within 8 hours of a workplace fatality or within 24 hours of any work-related inpatient hospitalization, amputation, or loss of an eye.
- Provide required training to all workers in a language and vocabulary they can understand.
- Prominently display this poster in the workplace.
- Post OSHA citations at or near the place of the alleged violations.

On-Site Consultation services are available to small and medium-sized employers, without citation or penalty, through OSHA-supported consultation programs in every state.



Contact OSHA. We can help.

1-800-321-OSHA (6742) • TTY 1-877-889-5627 • www.osha.gov

OSHA 3165-04R 2019

WORKER RIGHTS

UNDER THE DAVIS-BACON ACT

FOR LABORERS AND MECHANICS WORKING ON FEDERAL OR FEDERALLY ASSISTED CONSTRUCTION PROJECTS

The law requires employers to display this poster where workers can readily see it.

PREVAILING WAGES

You must be paid not less than the wage rate listed in the Davis-Bacon Wage Decision posted with this notice for the work you perform.

OVERTIME

You must be paid not less than one and one-half times your basic rate of pay for all hours worked over 40 in a work week. There are few exceptions.

ENFORCEMENT

Contract payments can be withheld to ensure workers receive wages and overtime pay due, and liquidated damages may apply if overtime pay requirements are not met. Davis-Bacon contract clauses allow contract termination and debarment of contractors from future federal contracts for three years. A contractor who falsifies certified payroll records or induces wage kickbacks may be subject to civil or criminal prosecution, fines and/or imprisonment.

APPRENTICES

Apprentice rates apply only to apprentices properly registered under approved federal or state apprenticeship programs.

RETALIATION

The law prohibits discharging or otherwise retaliating against workers for filing a complaint, cooperating in an investigation, or testifying in a proceeding under the Davis-Bacon and Related Acts.

PROPER PAY

If you do not receive proper pay, or require further information on the applicable wages, contact the Contracting Officer listed below:

or contact the U.S. Department of Labor's Wage and Hour Division.

WAGE AND HOUR DIVISION
UNITED STATES DEPARTMENT OF LABOR

866-487-9243
dol.gov/agencies/whd

WH1321 REV 07/24

EMPLOYEE RIGHTS

EMPLOYEE POLYGRAPH PROTECTION ACT

The Employee Polygraph Protection Act prohibits most private employers from using lie detector tests either for pre-employment screening or during the course of employment.

PROHIBITIONS

Employers are generally prohibited from requiring or requesting any employee or job applicant to take a lie detector test, and from discharging, disciplining, or discriminating against an employee or prospective employee for refusing to take a test or for exercising other rights under the Act.

EXEMPTIONS

Federal, State and local governments are not affected by the law. Also, the law does not apply to tests given by the Federal Government to certain private individuals engaged in national security-related activities.

The Act permits polygraph (a kind of lie detector) tests to be administered in the private sector, subject to restrictions, to certain prospective employees of security service firms (armored car, alarm, and guard), and of pharmaceutical manufacturers, distributors and dispensers.

The Act also permits polygraph testing, subject to restrictions, of certain employees of private firms who are reasonably suspected of involvement in a workplace incident (theft, embezzlement, etc.) that resulted in economic loss to the employer.

The law does not preempt any provision of any State or local law or any collective bargaining agreement which is more restrictive with respect to lie detector tests.

EXAMINEE RIGHTS

Where polygraph tests are permitted, they are subject to numerous strict standards concerning the conduct and length of the test. Examinees have a number of specific rights, including the right to a written notice before testing, the right to refuse or discontinue a test, and the right not to have test results disclosed to unauthorized persons.

ENFORCEMENT

The Secretary of Labor may bring court actions to restrain violations and assess civil penalties against violators. Employees or job applicants may also bring their own court actions.

THE LAW REQUIRES EMPLOYERS TO DISPLAY THIS POSTER WHERE EMPLOYEES AND JOB APPLICANTS CAN READILY SEE IT.

WAGE AND HOUR DIVISION
UNITED STATES DEPARTMENT OF LABOR

1-866-487-9243
www.dol.gov/agencies/whd

WH1462 REV 02/22

Know Your Rights:
Workplace Discrimination is Illegal

The U.S. Equal Employment Opportunity Commission (EEOC) enforces Federal laws that protect you from discrimination in employment. If you believe you've been discriminated against at work or in applying for a job, the EEOC may be able to help.

Who is Protected?

- Employees (current and former), including managers and temporary employees
- Job applicants
- Union members and applicants for membership in a union

What Organizations are Covered?

- Most private employers
- State and local governments (as employers)
- Educational institutions (as employers)
- Unions
- Staffing agencies

What Types of Employment Discrimination are Illegal?

Under the EEOC's laws, an employer may not discriminate against you, regardless of your immigration status, on the bases of:

- Race
- Color
- Religion
- National origin
- Sex (including pregnancy, childbirth, and related medical conditions, sexual orientation, or gender identity)
- Age (40 and older)
- Disability
- Genetic information (including employer requests for, or purchase, use, or disclosure of genetic tests, genetic services, or family medical history)
- Retaliation for filing a charge, reasonably opposing discrimination, or participating in a discrimination lawsuit, investigation, or proceeding
- Interference, coercion, or threats related to exercising rights regarding disability discrimination or pregnancy accommodation

What Employment Practices can be Challenged as Discriminatory?

All aspects of employment, including:

- Discharge, firing, or lay-off
- Harassment (including unwelcome verbal or physical conduct)
- Hiring or promotion
- Assignment
- Pay (unequal wages or compensation)
- Failure to provide reasonable accommodation for a disability; pregnancy, childbirth, or related medical condition; or a sincerely-held religious belief, observance or practice
- Benefits
- Job training
- Classification
- Referral
- Obtaining or disclosing genetic information of employees
- Requesting or disclosing medical information of employees
- Conduct that might reasonably discourage someone from opposing discrimination, filing a charge, or participating in an investigation or proceeding
- Conduct that coerces, intimidates, threatens, or interferes with someone exercising their rights, or someone assisting or encouraging someone else to exercise rights, regarding disability discrimination (including accommodation) or pregnancy accommodation

What can You Do if You Believe Discrimination has Occurred?

Contact the EEOC promptly if you suspect discrimination. Do not delay, because there are strict time limits for filing a charge of discrimination (180 or 300 days, depending on where you live/work). You can reach the EEOC in any of the following ways:

Submit an inquiry through the EEOC's public portal (https://publicportal.eeoc.gov/Portal/Login.aspx)

Visit an EEOC field office (www.eeoc.gov/field-office)

Call 1–800–669–4000 (toll free)
1–800–669–6820 (TTY)
1–844–234–5122 (ASL video phone)

E-Mail info@eeoc.gov

Additional information about the EEOC, including information about filing a charge of discrimination, is available at www.eeoc.gov.

EMPLOYERS HOLDING FEDERAL CONTRACTS OR SUBCONTRACTS

The Department of Labor's Office of Federal Contract Compliance Programs (OFCCP) enforces the nondiscrimination and affirmative action commitments of companies doing business with the Federal Government. If you are applying for a job with, or are an employee of, a company with a Federal contract or subcontract, you are protected under Federal law from discrimination on the following bases:

Race, Color, Religion, Sex, Sexual Orientation, Gender Identity, National Origin

Executive Order 11246, as amended, prohibits employment discrimination by Federal contractors based on race, color, religion, sex, sexual orientation, gender identity, or national origin, and requires affirmative action to ensure equality of opportunity in all aspects of employment.

Asking About, Disclosing, or Discussing Pay

Executive Order 11246, as amended, protects applicants and employees of Federal contractors from discrimination based on inquiring about, disclosing, or discussing their compensation or the compensation of other applicants or employees.

Disability

Section 503 of the Rehabilitation Act of 1973, as amended, protects qualified individuals with disabilities from discrimination in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment by Federal contractors. Disability discrimination includes not making reasonable accommodation to the known physical or mental limitations of an otherwise qualified individual with a disability who is an applicant or employee, barring undue hardship to the employer. Section 503 also requires that Federal contractors take affirmative action to employ and advance in employment qualified individuals with disabilities at all levels of employment, including the executive level.

Protected Veteran Status

The Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, 38 U.S.C. 4212, prohibits employment discrimination against, and requires affirmative action to recruit, employ, and advance in employment, disabled veterans, recently separated veterans (i.e., within three years of discharge or release from active duty), active duty wartime or campaign badge veterans, or Armed Forces service medal veterans.

Retaliation

Retaliation is prohibited against a person who files a complaint of discrimination, participates in an OFCCP proceeding, or otherwise opposes discrimination by Federal contractors under these Federal laws.

Any person who believes a contractor has violated its nondiscrimination or affirmative action obligations under OFCCP's authorities should contact immediately:

The Office of Federal Contract Compliance Programs (OFCCP)
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, D.C. 20210
1–800–397–6251 (toll-free)

If you are deaf, hard of hearing, or have a speech disability, please dial 7–1–1 to access telecommunications relay services. OFCCP may also be contacted by submitting a question online to OFCCP's Help Desk (https://ofccphelpdesk.dol.gov/s/), or by calling an OFCCP regional or district office, listed in most telephone directories under U.S. Government, Department of Labor and on OFCCP's "Contact Us" webpage (https://www.dol.gov/agencies/ofccp/contact).

PROGRAMS OR ACTIVITIES RECEIVING FEDERAL FINANCIAL ASSISTANCE

Race, Color, National Origin, Sex

In addition to the protections of Title VII of the Civil Rights Act of 1964, as amended, Title VI of the Civil Rights Act of 1964, as amended, prohibits discrimination on the basis of race, color or national origin in programs or activities receiving Federal financial assistance. Employment discrimination is covered by Title VI if the primary objective of the financial assistance is provision of employment, or where employment discrimination causes or may cause discrimination in providing services under such programs. Title IX of the Education Amendments of 1972 prohibits employment discrimination on the basis of sex in educational programs or activities which receive Federal financial assistance.

Individuals with Disabilities

Section 504 of the Rehabilitation Act of 1973, as amended, prohibits employment discrimination on the basis of disability in any program or activity which receives Federal financial assistance. Discrimination is prohibited in all aspects of employment against persons with disabilities who, with or without reasonable accommodation, can perform the essential functions of the job.

If you believe you have been discriminated against in a program of any institution which receives Federal financial assistance, you should immediately contact the Federal agency providing such assistance.

(Revised 6/27/2023)

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
REGION VII
Gateway Tower II, Room 200
400 State Avenue
Kansas City, KS 66101-2406
HUD Home Page: *www.hud.gov*

July 22, 2005

To All Community Development Block Grant (CDBG) Entitlement Communities/State CDBG and HOME Program

SUBJECT: Labor Standards Compliance Requirements for Self-Employed Laborers and Mechanics (aka Working Subcontractors) listed on Certified Payroll Reports (CPR's)

Labor Relations *Letter* LR-96-01 represents an effort to provide guidance for all principal contractors (also referred to as the *prime* contractor) is responsible for the full compliance of all employers (contractors, subcontractors, and any lower-tier subcontractors) with the labor standards provisions applicable to the project. For ease in reference, the term *"prime contractor"* shall mean the principal contractor, the term *"subcontractor"* shall mean all subcontractors and lower-tier subcontractors, and the term *"employer"* shall mean any contractor, subcontractor or lower-tier subcontractor that has engaged the services of laborers or mechanics on the project.

HUD policy clearly affords prevailing wage protection for all laborers and mechanics, regardless of contractual relationship. There is no exception to this protection for self-employed laborers or mechanics, including owners of businesses, sole-proprietors, partners, corporate officers, or others. This policy in no way precludes or limits any business or individual from participating in HUD-assisted construction work. The issue is not one of *eligibility,* whether such persons are permitted to work on HUD-assisted projects, but of compliance standards – what HUD will accept from contractors and subcontractors to demonstrate that proper compliance has been achieved.

In this context, this *Letter* establishes a HUD administrative policy that laborers and mechanics may not certify to the payment of their **own** prevailing wages **EXCEPT** where the laborer or mechanic is the owner of a business working on the site of the work with his/her own crew. (This exception is described in detail in Paragraph III. Owners of businesses working with their crew.

Owners of businesses working with their crew on the same HUD-assisted job site may certify to the payment of their own prevailing wages in conjunction with the prevailing wages paid to their employees. This exception to reporting standards *does not* suggest that such owners are not likewise entitled to prevailing wages for their labor. Rather, it accepts the wage payment certification on weekly payroll reports by the owner for his/her own wages as that certification *accompanies* the certification offered for the payment of prevailing wages to his/her employees. Such owners need only list their name, work classification including "owner," and the daily and total hours worked. (Such owners ***do not*** need to list a rate of pay or amounts earned.)

Also, HUD's Office of Labor Relations responsible for labor standards administration and enforcement ***may not*** accept certified payrolls reporting single or multiple owners (e.g., partners) certifying that they have paid to themselves the prevailing wage for their craft. For example, a sole-proprietor may not submit a payroll reporting himself or herself as simply "**Owner**" signing the certification as to his/her own wage payment from "draws" or other payment methods. Neither may several mechanics submit a payroll reporting themselves as "partners" with one or more certifying as to the payment of their wages or salaries. Such mechanics must instead be carried on the certified payroll of the contractor or subcontractor (the "responsible employer") for whom they are working and with whom they have executed a "contract" for services.

Enclosed is a copy of the Labor Relations *Letter* LR-96-01 for your review.

Should you or members of your staff have any questions concerning this *Letter* they may be directed to Headquarters Office of Labor Relations at (202) 708-0370 or in the case of construction projects/program participants to HUD Labor Relations staff at (913) 551-6882/6883/5577.

Sincerely,

Frank C. Bustamante
Regional Labor Relations Officer

LABOR STANDARDS COMPLIANCE REQUIREMENTS

Date: December 2, 1996 **(Rev 1) Letter No. LR-96-01**

Subject: **Labor standards compliance requirements for self-employe laborers and mechanics (aka *Working Subcontractors*)**

I. **HUD policy on prevailing wage applicability.**
II. **Compliance and certification parameters.**
III. **Owners of businesses working with their crews.**
IV. **Owner-Operators of power equipment.**
V. **Truck drivers.**

The Federal prevailing wage requirements and compliance standards for self-employed laborers and mechanics (also referred to as "working subcontractors") have long been a confusing and contentious area for the Department of Labor (DOL), HUD, the Internal Revenue Service and contractors and subcontractors.

The following policy represents an effort to provide practical guidance for field application. The guidance more specifically concerns the wage certification requirements for self-employed mechanics and laborers on projects subject to Federal labor standards provisions including Davis-Bacon and HUD-determined maintenance and nonroutine maintenance prevailing wage rate determinations. This policy does not attempt to establish whether working subcontractors are subject to Federal labor standards nor whether such working subcontractors are *bona fide*. The clear meaning of statutory provisions and regulatory definitions does not require further examination of applicability. Additionally, statutory and regulatory language are clear that the question of whether certain self-employed laborers and mechanics are bona fide subcontractors is not germane to the issue of prevailing wage standard applicability.

I. *HUD policy on prevailing wage applicability.*

The Davis-Bacon Act (DBA), HUD program Related Acts (DBRA) concerning the payment of prevailing wages as determined by the Secretary of Labor, and the U.S. Housing Act of 1937 concerning the payment of prevailing wage rates established by HUD provide that the wage protections afforded in these statutes apply to laborers and mechanics employed on the covered work. The DBA and DBRA implementing regulations (29 CFR Part 5) specifically stipulate that these protections are provided **regardless of any contractual relationship which may be alleged to exist** between the contractor and such laborers and mechanics. Additionally, all laborers and mechanics must be paid unconditionally and not less often than once per week. HUD has followed DBA/DBRA prevailing wage parameters in its implementation, administration and enforcement of HUD-determined maintenance and nonroutine maintenance prevailing wage standards. (*NOTE*: The requirement to pay weekly wages is not applicable to the payment of prevailing routine maintenance wage rates related to laborers and mechanics engaged in the operation of PHA and IHA housing developments.)

Therefore, it is HUD policy that in all cases where laborers and mechanics are employed on Federal prevailing wage-covered construction, maintenance and nonroutine maintenance work, laborers and mechanics shall be entitled to compensation (in the case of Davis-Bacon wages, *weekly* compensation) at wage rates not less than the prevailing rate for the type of work they perform **regardless of any contractual relationship alleged to exist between a contractor or subcontractor and such laborers or mechanics**.

The above policy statement is not a departure from previous HUD directives. The guidance presented below establishes uniform HUD-assisted program contract administration and enforcement parameters for labor standards compliance and prevailing wage certification.

II. *Compliance and certification parameters.*

HUD policy clearly affords prevailing wage protection for all laborers and mechanics, regardless of contractual relationship. There is no exception to this protection for self-employed laborers or mechanics, including owners of businesses, sole-proprietors, partners, corporate officers, or others. This policy in no way precludes or limits any business or individual from participating in HUD-assisted construction, maintenance, or nonroutine maintenance work. The

issue is not one of *eligibility*, whether such persons are permitted to work on HUD-assisted projects, but of compliance standards - what HUD will accept from contractors and subcontractors to demonstrate that proper compliance has been achieved.

In this context, this Letter establishes a HUD administrative policy that laborers and mechanics may not certify to the payment of their **own** prevailing wages **EXCEPT** where the laborer or mechanic is the owner of a business working on the site of the work with his/her own crew. (This exception is described in detail in Paragraph III. Owner-operators of power equipment are discussed in Paragraph IV; Truck drivers are discussed in Paragraph V.)

The most frequent occurrence of self-employed workers on HUD-assisted projects involves mechanic/trade classifications (i.e., not laborer classifications). (For ease of reference, laborers and mechanics in this context are referred to as "mechanics" and include any case involving laborers.) These mechanics may be represented as sole-proprietors, self-employed mechanics, partners, or corporate officers - all with no direct employees engaged in the covered work.

Accordingly, HUD, and program participants responsible for labor standards administration and enforcement (e.g., PHAs, IHAs, CDBG recipients), may not accept certified payrolls reporting single or multiple owners (e.g., partners) certifying that they have paid to themselves the prevailing wage for their craft. For example, a sole-proprietor may not submit a payroll reporting himself or herself as simply "Owner" signing the certification as to his/her own wage payment from "draws" or other payment methods. Neither may several mechanics submit a payroll reporting themselves as "partners" with one or more certifying as to the payment of their wages or salaries. Such mechanics must instead be carried on the certified payroll of the contractor or subcontractor (the "responsible employer") for whom they are working and with whom they have executed a "contract" for services.

In these cases, maintenance of an accurate accounting of weekly work hours including any overtime hours for such mechanics is essential. Whatever method of compensation computation is utilized (piecework, weekly contract draw for performance), the amount of weekly compensation divided by the actual hours of work performed for that week must result in an "effective" hourly wage rate for that week that is not less than the prevailing hourly rate for the type of work involved. This computation must take into account overtime pay rates (i.e., one and one half) for all hours worked in excess of 40 hours per

week, pursuant to the Contract Work Hours and Safety Standards Act (CWHSSA), where applicable, and pursuant to the Fair Labor Standards Act where CWHSSA is not applicable.

The name, work classification, actual hours of work, effective hourly wage rate, and wage payment for each such mechanic must be reported and certified on the responsible employer's weekly payroll. Note that the effective hourly wage rate for such mechanics may fluctuate from week to week. However, the effective hourly wage rate **may not** be less than the minimum prevailing rate for the respective craft. In any case where the effective rate falls below the corresponding craft prevailing wage rate, the responsible employer must compensate the mechanic at no less than the prevailing rate on the wage determination for that craft.

III. *Owners of businesses working with their crew.*
Owners of businesses working with their crew on the same HUD-assisted job site may certify to the payment of their own prevailing wages in conjunction with the prevailing wages paid to their employees. This exception to reporting standards *does not* suggest that such owners are not likewise entitled to prevailing wages for their labor. Rather, it accepts the wage payment certification on weekly payroll reports by the owner for his/her own wages as that certification *accompanies* the certification offered for the payment of prevailing wages to his/her employees. Such owners need only list their name, work classification including "owner," and the daily and total hours worked. (Such owners *do not* need to list a rate of pay or amounts earned.)
IV. ***Owner-operators of power equipment.***
Frequently, *owner-operators of power equipment* (e.g., backhoes, front-end loaders) will contract for services at a rate for both "man and machine." In these cases, the owner-operator includes liability, equipment maintenance, and salary in an hourly or contract rate for services. Because of the prevalence of such practice and the inherent difficulty in ascribing costs for liability and maintenance costs versus hourly *labor* salary, HUD and its program clients may accept a combined ("man and machine") hourly rate on the responsible contractor's certified payroll provided that such hourly rate may not be less than the rate on the wage determination for the respective power equipment operator.

Note: Owner-operators of power equipment, like self-employed mechanics, may not submit their own payrolls certifying to the payment of their own wages BUT must be carried on the responsible contractor's certified payroll report.
V. ***Truck drivers.***
As outlined earlier in this Letter, a DOL administrative policy excludes *bona fide owner-operators of trucks who are independent contractors* from DBRA/CWHSSA provisions concerning their own hours of work and rate(s) of pay. These truck "owner-operators" must be reported on weekly payrolls *but* the payrolls do not need to show the hours worked or rates - only the notation "Owner-operator." ***Note*** that any laborers or mechanics, including truck drivers, employed by the owner-operator/independent contractor are subject to DBRA/CWHSSA provisions in the usual manner.
This policy ***does not*** pertain to owner-operators of other equipment such as backhoes, bulldozers, cranes and scrapers (i.e., power equipment as noted in paragraph IV, above).
These compliance standards shall take effect immediately. Any exceptions to these standards must be approved in advance in writing by HUD Headquarters Office of Labor Relations.
Any questions concerning this *Letter* may be directed to the Office of Labor Relations at (202)708-0370 or, in the case of HUD program participants, to the HUD Field Labor Relations Staff with jurisdiction for your area.

Visit the Office of Davis-Bacon and Labor Standards.

Signage on CDBG Construction Projects

All Community Development Block Grant (CDBG) construction projects will be required to construct or have constructed a sign which indicates that the project is funded in part or in whole from the Kansas Department of Commerce, Community Development Block Grant program (with the exception of Housing and Urgent Need grants) and the U.S. Department of Housing and Urban Development (HUD) that funds the CDBG program. The following specifications are to be used for this signage:

1. Prior to start of construction, secure the services required to provide the layout of the Project Sign to be provided and installed by the Contractor. The sign should be mounted to obtain the maximum public visibility. This is an eligible construction expense, which should be included in the bid specifications.

2. Upon completion of the work, the sign should be removed from the premises by the contractor.

3. Unless otherwise approved by the project architect or engineer, there should be no other signs or advertising on the job site.

4. The following must be included on the signage:

    a. U.S. Department of Housing and Urban Development
    b. Community Development Block Grant
    c. Kansas Department of Commerce and grant amount
    d. Name of Grantee and project number
    e. Name of Kansas Governor
    f. Name of City/County Officials
    g. Name of Consultants: grant administrator, architect, engineer
    h. Name of Contractor(s) and Subcontractors, if applicable.

5. A proposed layout and sample are attached hereto. Maximum cost of sign should be no more than $750. Any cost above $750 is not CDBG eligible.

SAMPLE

City of Urban
U.S. Department of Housing and Urban Development
Community Development Block Grant
PROJECT # 20-PF-120
Kansas Department of Commerce $400,000

GOVERNOR

Governor Jane Smythe

CITY OFFICIALS:

Mayor John Doe
Council Member Jane Smith
Council Member Jim Jones

CONTRACTOR:

Anyone Construction, Inc.
Anywhere, Anyplace, KS

ARCHITECT:

Everyone, P.A.
Anywhere, Anyplace, KS

PLUMBING:

No One & Sons, Inc.
Anywhere, Anyplace, KS

ENGINEERS:

Busyone Company
Anywhere, Anyplace, KS

ELECTRICIAN:

Someone's Services, Inc.
Anywhere, Anyplace, KS

GRANT ADMINISTRATOR:

Joe Jones
Anywhere, Anyplace, KS

HVAC:

Workingone Company
Anywhere, Anyplace, KS


CITY OF MORAN
U.S. Department of Housing and Urban Development
Community Development Block Grant
CDBG PROJECT 22-PF-028
American Rescue Plan Act Funding- $77,000
KDHE State Revolving Loan Fund - $473,000
Kansas Department of Commerce CDBG Grant-$450,000
CITY OFFICALS: Mayor, Jerry Wallis
Council Members: James (Jim) Mueller | Warren Johnson
Kennneth (Ken) Kale | Corliss (Corky) Lynes | Kristofor (Kris) Smith
Engineers: Schwab Eaton
Schwab Eaton
Manhattan, KS
Contractor: Goins
Goins Enterprises, Inc.
Joplin, MO
Grant Administrator: THRIVE ALLEN COUNTY
Thrive Allen County
Iola, KS

Contractor's Requirements

- The Prime Contractor must submit a Section 3 plan to the Sub-Recipient outlining Section 3 hiring and employment opportunities.

- The Prime Contractor must notify all sub-contractors of their responsibilities under Section 3

- The Prime Contractor must provide a permeant workforce breakdown of all current employees and identify those Section 3 workers that were hired within the last five years.

- The Prime Contractor must provide an estimated breakdown of potential hires for the awarded project and timeline of anticipated hiring

- The Prime Contractor must refrain from contracting with sub-contractors as to whom they have received notice or have knowledge that the sub-contractors have been found in violation of the regulations in 24 CFR 75.

- Maintain records that document a good faith effort to utilize Section 3 workers and Target Section 3 workers as trainees and employees. (Required of both contractor and sub- contractor.) and any other qualitative efforts to comply with Section 3.

Recordkeeping requirements for recipients are found at 24 CFR § 75.31. The contractor is required to maintain documentation to demonstrate compliance with the regulations and is responsible for requiring their subcontractors to maintain or provide any documentation that will assist recipients in demonstrating compliance, including documentation that shows hours worked by Section 3 workers and Targeted Section 3 workers.

CERTIFICATION OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY

INSTRUCTIONS

This certification is required pursuant to Executive Order 11246 (30 F.R. 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause: and, if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the bidder has not filed a compliance report due under applicable instructions, such bidder shall be required to submit a compliance report within seven calendar days after bid opening. No contract shall be awarded unless such report is submitted.

CERTIFICATION BY BIDDER

Bidder Name _____

Address _____

City _____ State _____ Zip _____

1. Bidder has participated in a previous contract or subcontract subject ot the Equal Opportunity Clause.

   ☐ Yes ☐ No

2. Compliance reports were required to be filed in connection with such contract or subcontract.

   ☐ Yes ☐ No

3. Bidder has filed all compliance reports due under applicable instructions.

   ☐ Yes ☐ No

4. Have you ever been or are you being considered for sanction due to violation of Executive Order 11246, as amended?

   ☐ Yes ☐ No

Signer Name _____

Title _____

_____ _____

SIGNATURE DATE

Exhibit 1

CERTIFICATION OF BIDDER
REGARDING SECTION 3
AND SEGREGATED FACILITIES

Name of Proposed Contractor _____ Project Name & Number _____

The undersigned hereby certifies that:

a. Section 3 provisions are included in the Contract.

b. A written Section 3 plan was prepared and submitted as part of the bid proceedings

c. No segregated facilities will be maintained.

Signer Name _____

Title _____

SIGNATURE _____ DATE _____

Exhibit 1

CONTRACTOR SECTION 3 PLAN

(Contractor) agrees to implement affirmative steps to comply with the Section 3 requirements set forth at 24 CFR 75 directed at increasing the utilization of lower income residents and businesses within the City or County of _____.

A. To implement Section 3 requirements by seeking the assistance of local officials in determining the exact boundaries of the applicable project area.

B. To attempt to recruit from within the City/County the necessary number of lower income residents through local advertising media, signs placed at the proposed site for the project, and community organizations and public or private institutions operating within or serving the project area.

C. To maintain a list of all lower income residents who have applied either on their own or on referral from any source, and to employ such persons, if otherwise eligible and if a vacancy exits.

D. To insert this Section 3 plan in all bid documents, and to require all bidders to submit a Section 3 affirmative action plan including utilization goals and the specific steps planned to accomplish these goals.

E. To formally contact unions, subcontractors and trade associations to secure their cooperation for this program.

F. To maintain records, including copies of correspondence, memoranda, etc., which document that all the above affirmative action steps have been taken.

G. To appoint or recruit an executive official of the company or agency as Equal Opportunity Officer to coordinate the implementation of this Section 3 plan.

H. To list all permanent workforce for this project by job title.

I. To list all projected workforce needs for this project by job classification and time frame for potential hire.

As officers and representatives of _____
(Name of Bidder)

We, the undersigned, have read and fully agree to the above and become a party to the full implementation of this program.

_____
Signature

_____ _____
Title Date

Exhibit 2

Contractor Permanent Workforce Form

Form A1

This form is used to determine the Section 3 Workers already employed by the bidding contractor.
Section 3 Worker Certification (Form A2) is needed for all employees working on site.

Employee Name	Job Title	Certified Section 3 Worker		Monthly Salary	Salary Below 80% of Median	
		YES	NO		YES	NO

I certify the above employees are permanent employees of _____. I certify the above employees are on our regular monthly payroll and have their W-2 tax forms for our records. These records will be available to the city/county for the above referenced project for verification purposes. I understand that falsifying information is perjury and subject to legal ramifications.

_____ _____ _____

Print Name Signature Date

Exhibit 2

Section 3 Worker Certification

Form A2

A Section 3 Worker seeking the preference in training and employment provided by this part shall certify or submit evidence to the recipient contractor or subcontractor that the person is a Section 3 Worker, as defined in Section 24 CRF 75.

Worker Name: _____

Household Income Guidelines:
Place a check mark beside the number of people in your (the worker's) household.

Place Check	Household/ Family Size	Income Limit
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	

Income limits can be found at https://www.huduser.gov/portal/datasets/il.html

Place a check mark beside any of the following that apply below:

☐ My income for the previous year was below the amount next to the household/family size I checked on the table above.

☐ I am employed by a Section 3 business concern.

☐ I am a Youthbuild participant.

I hereby certify that the information provided by me to be true and correct and understand any falsification of any of the information could subject me to disqualification from participation.

Signature _____ **Date** _____

Exhibit 2

Section 3 Business Concern Certification Form

Form B1

To Self-Certify as a Section 3 Business your company/firm per 24 CFR 75, must meet one of the listed categories below. You must provide that supporting documentation with this form to be properly and completely confirmed as a Section 3 business.

Section 3 Business Category	Additional Required Data	Mark an "X" on Your Election
It is at least 51 percent owned by low- or very low-income persons;	Proof of ownership showing all owners and their percentages and a completed Section 3 Self-Certification form for all low- and very low-income owners	☐
Over 75 percent of the labor hours performed for the business are performed by low- or very low-income persons; or	Provide the last 90 days full payrolls for the entire company, make a list of the names from the payrolls of the Section 3 workers, and provide a completed Section 3 Individual Self-Certification for all low- and very low-income workers you list	☐
It is a business at least 51 percent owned by current public housing residents or residents who currently live in Section 8- assisted housing.	Proof of ownership showing all owners and their percentages and a Section 3 Worker Self Certification form for all public housing and/or Section 8 owners	☐

I hereby certify to the US Department of Housing and Urban Development (HUD) that all of the information on this form is true and correct. I attest under penalty of perjury that my business meets the elected definition and understand proof of this information may be requested. If found to be inaccurate, I understand that I may be disqualified as a certified Section 3 business

Signature: _____ Date Signed: _____

Print Name: _____ Title: _____

Company Name: _____

Address: _____

Telephone Number: _____

Exhibit 2

Section 3 Business Owner Certification
Form B2

A business owner seeking Section 3 Business Certification shall certify and submit this form in conjunction with the Section 3 Business Self-Certification form.

Owner Name: _____

Percent Ownership of Business: _____

Household Income Guidelines:
Place a check mark beside the number of people in your (the owner's) household.

Place Check	Household/ Family Size	Income Limit
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	

Income limits can be found at https://www.huduser.gov/portal/datasets/il.html

Place a check mark beside any of the following that apply below:

☐ My income for the previous year was below the amount next to the household/family size I checked on the table above.

☐ I am currently a resident of public housing or live in Section 8 assisted housing.

I hereby certify that the information provided by me to be true and correct and understand any falsification of any of the information could subject me to disqualification from participation.

_____ _____
Employee Signature Date

COMMUNITY DEVELOPMENT BLOCK GRANT PROGRAM

CONTRACTOR'S CERTIFICATION

CONCERNING LABOR STANDARDS AND PREVAILING WAGE REQUIREMENTS

To (Appropriate Recipient) _____ Date _____

Project No. (if any) _____

c/o _____ Project Name _____

1. The undersigned, having executed a contract with _____ for the construction of the above-identified project, acknowledges that:

   a. The Labor Standards provisions are included in the aforesaid contract.

   b. Correction of any infractions of the aforesaid condition, including infractions by any of his subcontractors and any lower tier subcontractors, is his responsibility.

2. He certifies that:

   a. Neither he nor any firm, partnership or association in which he has substantial interest is designated as an ineligible contractor by the Comptroller General of the United States pursuant to Section 5.6(b) of the Regulations of the Secretary of Labor, Part 5 (29 CFR, Part 5) or pursuant to Section 3(a) of the Davis-Bacon Act, as amended (40 U.S.C. 476a-2(a)).

   b. No part of the aforementioned contract has been or will be subcontracted to any subcontractor if each subcontractor or any firm, corporation, partnership or association in which such subcontractor has a substantial interest is designated as an ineligible contractor pursuant to any of the aforementioned regulatory or statutory provisions.

3. He agrees to obtain and forward to the aforementioned recipient within ten days after the execution of any subcontract, including those executed by his subcontractors and any lower tier subcontractors, a Subcontractor's Certification Concerning Labor Standards and Prevailing Wage Requirements executed by the subcontractors.

4. He certifies that:

   a. The legal name and the business address of the undersigned are:

   _____

   b. The undersigned is:

   _____

   1. A SINGLE PROPRIETORSHIP
   2. A PARTNERSHIP
   3. A CORPORATION ORGANIZED IN THE STATE OF _____
   4. OTHER ORGANIZATION (Describe) _____

c. The name, title and address of the owner, partners or officers of the undersigned are:

NAME	TITLE	ADDRESS

d. The names and addresses of all other persons, both natural and corporate, having a substantial interest in the undersigned, and the nature of the interest are (if none, so state):

NAME	ADDRESS	NATURE OF INTEREST

e. The nameS, addresses and trade classifications of all other building construction contractors in which the undersigned has a substantial interest are (if none, so state):

NAME	ADDRESS	TRADE CLASSIFICATION

_____
Contractor

By: _____ _____
Signature Date

WARNING

U.S. Criminal Code, Section 1010, Title 18, U.S.C., provides in part: “Whoever….makes, passes, writes or publishes any statement, knowing the same to be false…..shall be fined not more than $5,000 or imprisoned not more than two years, or more.”

COMMUNITY DEVELOPMENT BLOCK GRANT PROGRAM

GRANT REGULATIONS

BONDING AND INSURANCE REQUIREMENTS

A state or local unit of government receiving a grant from the Federal government, which requires contracting for construction or facility improvements, shall follow Federal bonding requirements on all contracts exceeding $100,000. For contracts between $25,000 - $100,000 some form of bonding security is also required. For contract under $25,000 the State CDBG program recommends some form of security such as a Certificate of Deposit or a line of credit from a lending institution.

For Contracts or subcontracts exceeding $100,000, the Federal agency may accept the bonding policy and requirements of the grantee provided the Federal agency has made a determination that the Government's interest is adequately protected. If such a determination has not been made, the minimum requirements shall be as follows:

a. A bid guarantee from each bidder equivalent to five percent of the bid price. The "bid guarantee" shall consist of a firm commitment such as a bid bond, certified check, or other negotiable instrument accompanying a bid as assurance that the bidder will, upon acceptance of his/her bid, execute such contractual documents as may be required within the time specified.

b. A performance bond on part of the contractor for 100 percent of the contract price. A "performance bond" is executed in connection with the contract to secure fulfillment of all contractor's obligations under such contract.

c. A payment bond on the part of the contractor for 100 percent of the contract price. A "payment bond" is one executed in connection with contract to assure payment as required by law of all person supplying labor and materials in the execution of the work provided for in the contract.

The State of Kansas CDBG program, through adoption of the federal policy and amending it to fit the State's program needs, extends the above bonding requirements to cover all contracts that exceed $25,000. Allowance is made for local requirements to prevail for contracts between $25,000 and $100,000 as long as the bid and the subsequent contract is secured to protect the grantee and the Federal funds. CDBG also recommends some type of security on all construction contracts under $25,000, such as a line of credit, cash deposit in bank for term of project, etc.

All bonds shall be procured from a surety company registered and licensed to do business in the State of Kansas and countersigned by its Kansas resident agent.

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

3. The undersigned shall require that the language of this certifications be included in the contract documents for all subcontractors at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Date	Contractor

CDBG SMALL CITIES
POLICY BULLETIN 2024-02

Kansas Department of Commerce
Quality Places

DATE: December 31, 2024
TO: CDBG Grantees and Interested Parties
FROM: Andrew Hayman, CDBG Director
RE: Unique Entity IDs and Excluded Parties

Community Development Block Grant
1000 SW Jackson St., Suite 100
Topeka, KS 66612-1354
Phone: (785) 296-3481
Fax: (785) 296-3490
TTY: 711
E-mail: CDBG@ks.gov
KansasCommerce.gov

The purpose of this Bulletin is to remind grantees and grant administrators of the requirements and best practices in securing necessary UEIs and ensuring that contractors working on CDBG projects are not debarred or suspended from participation in federally funded projects.

Unique Entity IDs

A grantee and prime contractor on a CDBG-funded project must register with SAM.gov to receive a Unique Entity ID (UEI) and must be in an "Active Registration" status. Subrecipients and subcontractors* must register with SAM.gov and receive a UEI, however, they do not require an "Active Registration" status. The UEI number must be provided to the prime contractor and grantee as soon as possible.

A grantee, subrecipient, contractor, or subcontractor who is not a registered entity in SAM.gov must request a Unique Entity ID as soon as possible. Even if the entity already has a DUNS Number, they will need to request a Unique Entity ID to participate in federally funded projects.

Refer to the FAQ at the Federal Service Desk to obtain a UEI. Registrations must be updated and renewed each year to remain active. For more information on registering a new entity, follow this link to the FAQ. Follow these steps to renew an existing entity.

> ***Subrecipients and subcontractors do not need to receive an "Active Registration" in SAM.gov. The organization is required to obtain a UEI, but it can be in an "ID Assigned" status.**

See Excluded Parties below for further information about contractor verifications.

Excluded Parties

Any organization that is debarred or suspended or is otherwise excluded from or ineligible from or ineligible for participation in federally assisted programs shall be deemed an Excluded Party.

Grantees must not award any contract to any organization that is considered an Excluded Party. This applies to any CDBG-assisted contract at any tier in the process. Contracts that are equal to or greater than $25,000 are considered a "Covered Transaction" and are subject to the excluded parties' requirements under this bulletin. Contracts that are below $25,000 are not subject to the excluded parties' section under this bulletin.

- Prior to contract execution ($25,000 or more), the grantee must check the organization's name against the SAM.gov found at https://sam.gov/content/home.
- The grantee must document that the organization is not on the exclusions list with a screenshot from SAM.gov showing the results of an exclusion search - OR- a copy of a self-certification form completed by the lower tier contractor certifying they are not suspended or debarred (see attachment).
- The grantee must also document if the organization was not subject to an excluded parties' check per the requirements of this bulletin and the reason(s) why it is exempt.

Documentation proving verification of contractor eligibility, prior to contract execution, will be checked at monitoring.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION,
INELIGIBILITY AND VOLUNTARY EXCLUSION LOWER TIER COVERED TRANSACTIONS

This certification is required by the regulations implementing Executive Orders 12549 and 12689, Debarment and Suspension, and 2 CFR 2424.220, Participants' responsibilities.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS BELOW)

(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Grant Number: _____ Name of Participant: _____

Address of Participant: _____

_____	_____	_____
Name and Title of Authorized Representative	**Signature**	**Date**

1. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction", "debarred", "suspended", "ineligible", "lower tier covered transaction", "participant", "person", "primary covered transaction", "principal", "proposal", and "voluntarily excluded", as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Orders 12549 and 12689.
5. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -- Lower Tier Covered Transactions", without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may check the System for Award Management (SAM).
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Community Development Block Grant Program

GENERAL CONDITIONS

1. Contract and Contract Documents

The project to be constructed pursuant to this contract will be financed with assistance from the Department of Housing and Urban Development and is subject to all applicable Federal laws and regulations.

The Plans, Specifications and Addenda, hereinafter enumerated in Paragraph 1 of the Supplemental General Conditions shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents, titles, headings, running headlines, and marginal notes contained herein, and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.

Contents*

1. Contract and Contract Documents
2. Definitions
3. Additional Instructions and Detail Drawings
4. Shop or Setting Drawings
5. Materials, Services, and Facilities
6. Contractor's Title to Materials
7. Inspection and Testing of Materials
8. "Or Equal" Clause
9. Patents
10. Surveys, Permits and Regulations
11. Contractor's Obligations
12. Weather Conditions
13. Protection of Work and Property-Emergency
14. Inspection
15. Reports, Records and Data
16. Superintendence by Contractor
17. Changes in Work
18. Extras
19. Time for Completion and Liquidated Damages
20. Correction of Work
21. Subsurface Conditions Found Different
22. Claims for Extra Cost
23. Right of Owner to Terminate Contract
24. Construction Schedule and Periodic Estimates
25. Payments to Contractor
26. Acceptance of Final Payments as Release
27. Payments by Contractor
28. Insurance
29. Contract Security
30. Additional or Substitute Bond
31. Assignments
32. Mutual Responsibility of Contractors
33. Separate Contracts
34. Subcontracting
35. Architect/Engineer's Authority
36. State Allowances
37. Use of Premises and Removal of Debris
38. Quantities of Estimate
39. Lands and Rights-of-Way
40. General Guarantee
41. Conflicting Conditions
42. Notice and Service Thereof
43. Required Provisions Deemed Inserted
44. Protection of Lives and Health
45. Subcontractors
46. Interest of Member of Congress
47. Other Prohibited Interests
48. Use Prior to Owner's Acceptance
49. Photographs
50. Suspension of Work
51. Minimum Wages
52. Underpayment of Wages
53. Anticipated Fringe Benefits
54. Overtime Compensation
55. Apprentices
56. Employment Prohibited
57. Compliance with Ant-Kickback Act
58. Classifications Not Listed
59. Fringe Benefits Not Expressed
60. Posting Wage Rates
61. Complaints, Proceedings or Testimony
62. Claims and Disputes
63. Questions Concerning Regulations
64. Payrolls and Records
65. Specific Coverage
66. Ineligible Subcontractors
67. Provisions to be Included
68. Breach of Labor Standards
69. Employment Practices
70. Contract Termination; Debarment

* Attachment to Federal Labor Standards Provisions

2. Definitions

The following terms as used in this contract are respectively defined as follows:

a. "Contractor": A person, firm or corporation with whom the contract is made by the Owner.

b. "Subcontractor": A person, firm or corporation supplying labor and materials or only labor for work at the site of the project for, and under separate contract or agreement with the contractor.

c. "Work on (at) the project": Work to be performed at the location of the project, including the transportation of materials and supplies to or from the location of the project by employees of the Contractor and any Subcontractor.

3. Additional Instructions and Detail Drawings

The Contractor will be furnished additional instructions and detail drawings as necessary to carry out the work included in the contract. The additional drawings and instructions thus supplied to the Contractor will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as part thereof. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions. The Contractor and the Architect/Engineer will prepare jointly (a) a schedule, fixing the dates at which special detail drawings will be required, such drawings, if any, to be furnished by the Architect/Engineer in accordance with said schedule, and (b) a schedule fixing the respective dates for the submission of shop drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment, and the completion of the various parts of the work: each such schedule to be subject to change from time to time in accordance with the progress of the work.

4. Shop or Setting Drawings

The Contractor shall submit promptly to the Architect/Engineer two copies of each shop or setting drawing prepared in accordance with the schedule predetermined as aforesaid. After examination of such drawings by the Architect/Engineer and the return thereof, the Contractor shall make such corrections to the drawings as have been indicated and shall furnish the Architect/Engineer with two corrected copies. If requested by the Architect/Engineer the Contractor must furnish additional copies. Regardless of corrections made in or approval given to such drawings by the Architect/Engineer, the Contractor will nevertheless be responsible for the accuracy of such drawings and for their conformity to the Plans and Specifications, unless he notifies the Architect/Engineer in writing of any deviations at the time he furnishes such drawings.

5. Materials, Services, and Facilities

a. It is understood that except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

b. Any work necessary to be performed after regular working hours, on Sundays or Legal Holidays, shall be performed without additional expense to the Owner.

6. Contractor's Title to Materials

No materials or supplies for the work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The contractor warrants that he has good title to all materials and supplies used by him in the work, free from all liens, claims or encumbrances.

7. Inspection and Testing of Materials

   a. All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Owner. The owner will pay for all laboratory inspection service direct and not as a part of the contract.

   b. Materials or construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

8. "Or Equal" Clause

   Whenever a material, article or piece of equipment is identified on the plans or in the specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard; and, any material, article, or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or equipment so proposed, is, in the opinion of the Architect/Engineer, of equal substance and function. It shall not be purchased or installed by the Contractor without the Architect/Engineer's written approval.

9. Patents

   a. The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.

   b. License or Royalty Fees: License and/or Royalty Fees for the use of a process which is authorized by the Owner of the project must be reasonable, and paid to the holder of the patent, or his authorized licensee, direct by the Owner and not by or through the Contractor.

   c. If the Contractor uses any design, device or materials covered by letters, patent or copyright, shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, that, without exception, the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his Sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or this contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

10. Surveys, Permits, and Regulations

    Unless otherwise expressly provided for in the Specifications, the Owner will furnish to the Contractor all surveys necessary for the execution of the work.

    The Contractor shall procure and pay all permits, licenses and approvals necessary for the execution of his contract.

    The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to performance of the work, the protection of adjacent property, and the maintenance of passageways, guard fences or other protective facilities.

11. Contractor's Obligations

The Contractor shall and will in good workmanlike manner, do and perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by this contract, within the time herein specified, in accordance with the provisions of this contract and said specifications and in accordance with the plans and drawings covered by this contract any and all supplemental plans and drawings, and in accordance with the directions of the Architect/Engineer as given from time to time during the progress of the work. He shall furnish, erect, maintain, and remove such construction plant and such temporary work as may be required.

The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the contract and specifications, and shall do, carry on, and complete the entire work to the satisfaction of the Architect/Engineer and the Owner.

12. Weather Conditions

In the event of temporary suspension of work, or during inclement weather, or whenever the Architect/Engineer shall direct, the Contractor will, and will cause his subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Architect/Engineer, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors so to protect his work, such materials shall be removed and replaced at the expense of the Contractor.

13. Protection of Work and Property – Emergency

The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this contract. He shall at all times safely guard and protect his own work and that of adjacent property from damage. The Contractor shall replace or make good any such damage, loss or injury unless such be caused directly by errors contained in the contract or by the Owner, or his duly authorized representatives.

In case of any emergency which threatens loss or injury of property, and/or safety of life, the Contractor will be allowed to act without previous instructions from the Architect/Engineer, in a diligent manner. He shall notify the Architect/Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted to the Architect/Engineer for approval.

Where the Contractor has not taken action but has notified the Architect/Engineer of any emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the Architect/Engineer.

The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in Paragraph 17 of the General Conditions.

14. Inspection

The authorized representatives and agents of the Department of Housing and Urban Development and/or the Department of Commerce shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records.

15. Reports, Records, and Data

The Contactor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records, and other data as the Owner may request concerning work performed or to be performed under this contract.

16. Superintendence by Contractor

At the site of the work the Contractor shall employ a construction superintendent or foreman who shall have full authority to act for the Contractor. It is understood that such representative shall be acceptable to the Architect/Engineer and shall be one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll.

17. Changes in Work

No changes in the work covered by the approved Contract Documents shall be made without having prior written approval of the Owner. Charges or credits for the work covered by the approved change shall be determined by one or more, or a combination of the following methods:

a. Unit bid prices previously approved.

b. An agreed lump sum.

c. The actual cost of:

1. Labor, including foremen;
2. Materials entering permanently into the work;
3. The ownership or rental cost of construction plant and equipment during the time of use on the extra work;
4. Power and consumable supplies for the operation of power equipment;
5. Insurance
6. Social Security and old age and unemployment contributions. To the cost under (c) there shall be added a fixed fee to be agreed upon but not to exceed fifteen percent (15%) of the actual cost of supervision, overhead, bond, profit, and any other general expenses.

18. Extras

Without invalidating the contract, the Owner may order extra work or make changes by altering, adding to or deducting from the work, the contract sum being adjusted accordingly, and the consent of the Surety being first obtained where necessary or desirable. All the work of the kind bid upon shall be paid for at the price stipulated in the proposal, and no claims for any extra work or materials shall be allowed unless the work ordered in writing by the Owner or its Architect/Engineer, acting officially for the Owner, and the price is stated in such order.

19. Time for Completion and Liquidated Damages

It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the contract of the work to be done hereunder are ESSENTIAL CONDITIONS of this contract; and it is further mutually understood and agreed that the work embraced in this contract shall be commenced on a date to be specified in the "Notice to Proceed."

The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

If the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this contract, to pay to the Owner the amount specified in the contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the contract for completing the work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

It is further agreed that time is of the essence of each and every portion of this contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this contract.

Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner. Provided, further, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

a. To any preference, priority or allocation order duly issued by the Government;

b. To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather; and

c. To any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article:

Provided, further, that the Contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the contract, notify the Contractor within a reasonable time of its decision in the matter.

20. Correction of Work

All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the Architect/Engineer who shall be the final judge of the quality and suitability of the work, materials, processes of manufacture, and methods of construction for the purposes for which they are used. Should they fail to meet his approval they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the Contractor at his own expense. Rejected material shall immediately be removed from the site. If, in the opinion of the Architect/Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as in the judgment of the Architect/Engineer shall be equitable.

21. Subsurface Conditions Found Different

Should the Contractor encounter sub-surface and/or latent conditions at the site materially differing from those shown on the Plans or indicated in the Specifications, he shall immediately give notice to the Architect/Engineer of such conditions before they are disturbed. The Architect/Engineer will thereupon promptly investigate the conditions, and if he finds that they materially differ from those shown on the Plans, or indicated in the Specifications, he will at once make such changes in the Plans and/or Specifications as he may find necessary, any increase or decrease of cost resulting from such changes to be adjusted in the manner provided in Paragraph 17 of the General Conditions.

22. Claims for Extra Cost

No claim for extra work or cost shall be allowed unless the same was done in pursuance of a written order of the Architect/Engineer approved by the Owner, as aforesaid, and the claim presented with the first estimate after the changed or extra work is done. When work is performed under the terms of subparagraph 17(c) of the General Conditions, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items or cost and when requested by the Owner, give the Owner access to accounts relating thereto.

23. Right of Owner to Terminate Contract

In the event that any of the provisions of this contract are violated by the Contractor or by any of his subcontractors, the Owner may serve written notice upon the Contractor and the Surety of its intention to terminate the contract, such notices to contain the reasons for such intention to terminate the contract, and unless within ten (10) days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement of correction be made, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the Surety and the Contractor and the Surety shall have the right to take over and perform the contract; Provided, however, that if the Surety does not commence performance thereof within ten (10) days from the date of the mailing to such Surety of notice of termination, the Owner may take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the Contractor and the Contractor and his Surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefor.

24. Construction Schedule and Periodic Estimates

Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in form satisfactory to the Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due the Contractor in accordance with the progress schedule. The Contractor shall also furnish on forms to be supplied by the owner (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.

25. Payments to Contractor

a. Not later than the 15th day of each calendar month the Owner shall make a progress payment to the Contractor on the basis of a duly certified and approved estimate of the work performed during the preceding calendar month under this contract, but to insure the proper performance of this contract, the Owner shall retain ten percent (10%) of the amount of each estimate until final completion and acceptance of all work covered by this contract: Provided, that the Contractor shall submit his estimate not later than the first day of the month: Provided, further, that the Owner at any time after fifty percent (50%) of the work has been completed, if it finds that satisfactory progress is being made, may make any of the remaining progress payments in full: Provided further, that on completion and acceptance of each separate building, public work, or other division of the contract, on which the price is stated separately in the contract, payment may be made in full, including retained percentages thereon, less authorized deductions.

b. In preparing estimates the material delivered on the site and preparatory work done may be taken into consideration.

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

d. Owner's Right to Withhold Certain Amounts and Make Application Thereof: The Contractor agrees that he will indemnify and save the Owner harmless from all claims growing out of the lawful demands of subcontractors, laborers, workmen, mechanics, material, men, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged, or waived. If the Contractor fails so to do, then the Owner may, after having served written notice on the said Contractor, either pay unpaid bills, of which the Owner has written notice, direct, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the contractor shall be resumed, in accordance with the terms of this contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor or his Surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner shall be considered as a payment made under the contract by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

26. Acceptance of Final Constitutes Release

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and liability to the Contractor for all things done or furnished in connection with this work and for every act and neglect of the Owner and others relating to or arising out of his work. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations under this contractor or the Performance and Payment Bond.

27. Payments by Contractor

The Contractor shall pay (a) for all transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered, (b) for all materials, tools and other expendable equipment to the extent of ninety percent (90%) of the cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools, and equipment are delivered at the site of the project, and the balance of the cost thereof, not later than the 30th day following the completion of that part of the work in or on which such materials, tolls, and equipment are incorporated or used, and (c) to each of his subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his subcontractors to the extent of each subcontractor's interest therein.

28 Insurance

The Contractor shall not commence work under this contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his subcontract until the insurance required of the subcontractor has been so obtained and approved.

a. Compensation Insurance: The Contractor shall procure and shall maintain during the life of this contract Workmen's Compensation Insurance as required by applicable State or territorial law for all of his employees to be engaged in work at the site of the project under this contract and, in case of any such work sublet, the Contractor shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees to be engaged in such work

unless such employees are covered by the protection afforded by the Contractor's Workmen's Compensation Insurance. In case any class of employees engaged in hazardous work on the project under this contract is not protected under the Workmen's Compensation Statute, the Contractor shall provide and shall cause each subcontractor to provide adequate employees as are not otherwise protected.

b. Contractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance: The Contractor shall procure and maintain during the life of this contract Contractor's Public Liability Insurance, Contractor's Property Damage Insurance and Vehicle Liability Insurance in the amounts specified in the Supplemental General Conditions.

c. Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance: The Contractor shall either (1) require each of his subcontractors to procure and to maintain during the life of this subcontract, Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance of the type and of the amounts specified in the Supplemental General Conditions specified in subparagraph (b) hereof or, (2) insure the activities of his policy, specified in subparagraph (b) hereof.

d. Scope of Insurance and Special Hazards: The insurance required under subparagraphs (b) and (c) hereof shall provide adequate protection for the Contractor and his subcontractors, respectively, against damage claims which may arise from operations under this contract, whether such operations by the insured or by anyone directly or indirectly employed by him and, also against any of the special hazards which may be encountered in the performance of this contract as enumerated in the Supplemental General Conditions.

e. Builder's Risk Insurance (Fire and Extended Coverage): Until the project is completed and accepted by the Owner, the Owner, of Contractor (at the Owner's option as indicated in the Supplemental General Conditions, Form HUD-4238-N) is required to maintain Builder's Risk Insurance (fire and extended coverage) on a 100 percent completed value basis on the insurable portion of the project for the benefit of the Owner, the Contractor, or subcontractors as their interests may appear. The Contractor shall not include any costs for Builder's Risk Insurance (fire and extended coverage) premiums during construction unless the Contractor is required to provide such insurance; however, this provision shall not release the Contractor from his obligation to complete, according to plans and specifications, the project covered by the contract, and the Contractor and his Surety shall be obligated to full performance of Contractor's undertaking.

f. Proof of Carriage of Insurance: The Contractor shall furnish the Owner with certificates showing the type, amount, class of operation covered, effective dates and date of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this certificate will not be cancelled or materially altered, except after ten (10) days written notice has been received by the Owner."

29. Contract Security

The Contractor shall furnish a performance bond in an amount of at least equal to one hundred percent (100%) of the contract prices as security for the faithful performance of this contract and also a payment bond in an amount not less than one hundred percent (100%) of the contract price or in a penal sum not less than that prescribed by State, territorial or local law, for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract. The performance bond and the payment bond may be in one or in separate instruments in accordance with local law.

30. Additional or Substitute Bond

If at any time the Owner for justifiable cause shall be or become dissatisfied with any surety or sureties, then upon the Performance or Payment Bonds, the Contractor shall within five (5) days after notice from the Owner so to do, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished such an acceptable bond to the Owner.

31. Assignments

The Contractor shall not assign the whole or any part of this contract or any moneys due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any moneys due or to become due under this contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations of services rendered or materials supplied for the performance of the work called for in this contract.

32. Mutual Responsibility of Contractors

If, through acts of neglect on the part of the Contractor, any other Contractor or any subcontractor shall suffer loss or damage on the work, the Contractor agrees to settle with such other Contractor or subcontractor by agreement or arbitration if such other Contractor or subcontractors will so settle. If such other Contractor or subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim.

33. Separate Contract

The Contractor shall coordinate his operations with those of other Contractors. Cooperation will be required in the arrangement for the storage of materials and in the detailed execution of the work. The Contractor, including his subcontractors, shall keep informed of the progress and the detail work of other Contractors and shall notify the Architect/Engineer immediately of lack of progress or defective workmanship on the part of other Contractors. Failure of a Contractor to keep informed of the work progressing on the site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by him of the status of the work as being satisfactory for proper coordination with his own work.

34. Subcontracting

a. The Contractor may utilize the services of specialty subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty subcontractors.

b. The Contractor shall not award any work to any subcontractors without prior written approval of the Owner, which approval will not be given until the Contractor submits to the Owner a written statement concerning the proposed award to the subcontractor, which statement shall contain such information as the Owner may require.

c. The Contractor shall be as fully responsible to the Owner for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

d. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and other contract documents insofar as applicable to the work of subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the contract documents.

e. Nothing contained in this contract shall create any contractual relation between any subcontractor and the Owner.

35. Architect/Engineer's Authority

The Architect/Engineer shall give all orders and directions contemplated under this contract and specifications, relative to the execution of the work. The Architect/Engineer shall determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under this contract and shall decide all questions which may arise in relation to said work and the construction thereof. The Architect/Engineer's estimates and decisions shall be final and conclusive, except as herein otherwise expressly provided. In case any question shall arise between the parties hereto relative to said contract or specifications, the determinations or decision of the Architect/Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.

The Architect/Engineer shall decide the meaning and intent of any portion or of the specifications and of any plans or drawings where the same may be found obscure or be in dispute. Any differences or conflicts in regard to their work which may arise between the Contractor under this contract and other Contractors performing work for the Owner shall be adjusted and determined by the Architect/Engineer.

36. Stated Allowances

The Contractor shall include in his proposal the cash allowances stated in the Supplemental General Conditions. The Contractor shall purchase the "Allowed Materials" as directed by the Owner on the basis of the lowest and best bid of at least three competitive bids. If the actual price for purchasing the "Allowed Materials" is more or less than the "Cash Allowance," the contract price shall be adjusted accordingly. The adjustment in contract price shall be made on the basis of the purchase price without additional charges for overhead, profit, insurance or any other incidental expenses. The cost of installation of the "Allowed Materials" shall be included in the applicable sections of the Contract Specifications covering this work.

37. Use of Premises and Removal of Debris

The Contractor expressly undertakes at his own expense:

a. To take every precaution against injuries to persons or damage to property;

b. To store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not unduly interfere with the progress of his work or the work of any other contractors';

c. To place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work;

d. To clean up frequently all refuse, rubbish, scrap material, and debris caused by his operations, to the end that all times the site of the work shall present a neat, orderly and workmanlike appearance;

e. Before final payment to remove all surplus material, false-work, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in a neat, orderly condition;

f. To effect all cutting, fitting or patching of his work required to make the same to conform to the plans and specifications and, except with the consent of the Architect/Engineer, not to cut or otherwise alter the work of any other Contractor.

38. Quantities of Estimate

Wherever the estimated quantities of work to be done and materials to be furnished under this contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated by this contract, and such increase or diminution shall in no way violate this contract, nor shall any such increase or diminution give cause for claims or liability for damages.

39. Lands and Rights-of-Way

Prior to the start of construction, the Owner shall obtain all lands and rights-of-way necessary for the carrying out the completion of work to be performed under this contract.

40. General Guaranty

Neither the final certificate of payment nor any provision in the Contract Documents, nor partial or entire occupancy of the premises by the Owner, shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of final acceptance of the work unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.

41. Conflicting Conditions

Any provisions in any of the Contract Documents which may be in conflict or inconsistent with any of the paragraphs in these General Conditions shall be void to the extent of such conflict or inconsistency.

42. Notice and Service Thereof

Any notice to any Contractor from the Owner relative to any part of this contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted, by certified or registered mail, to the said Contractor at his last given address, delivered in person to the said Contractor or his authorized representative of the work.

43. Provisions Required by Law Deemed Inserted

Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party the contract shall forthwith by physically amended to make such insertion or corrections.

44. Protection of Lives and Health

“The Contractor shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the site, which occur as a result of his prosecution of the work. The safety provisions of applicable laws and building and construction codes, in addition to specific safety and health regulations described by Chapter XIII, Bureau of Labor Standards, Department of Labor, Part 1518, Safety and Health Regulations for Construction, as outlined in the Federal Register, Volume 36, No. 75, Saturday, April 17, 1971. Title 29 – LABOR, shall be observed and the Contractor shall take or cause to be taken, such additional safety and health measures as the Contracting Authority may determine to be reasonably necessary.”

45. Subcontracts

"The Contractor will insert in any subcontracts the Federal Labor Standards Provisions contained herein and such other clauses as the Department of Housing and Urban Development may, by instructions required, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made."

46. Interest of Member of or Delegate to Congress

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

47. Other Prohibited Interests

No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction, or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part hereof. No officer, employee, architect, attorney, engineer, or inspector of or for the owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

48. Use and Occupancy Prior to Acceptance by Owner

The Contractor agrees to the use and occupancy of a portion or unit of the project before formal acceptance by the Owner, provided the Owner:

a. Secures written consent of the Contractor except in the event, in the opinion of the Architect/Engineer, the Contractor is chargeable with unwarranted delay in final cleanup of punch list items or other contract requirements.

b. Secures endorsement from the insurance carrier and consent of the surety permitting occupancy of the building or use of the project during the remaining period of construction, or,

c. When the project consists of more than one building, and one of the buildings is occupied, secures permanent fire and extended coverage insurance, including a permit to complete construction. Consent of the surety must also be obtained.

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

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

49. Photographs of the Project

If required by the Owner, the Contractor shall furnish photographs of the project, in the quantities and as described in the Supplemental General Conditions.

50. Suspension of Work

Should the Owner be prevented or enjoined from proceeding with work either before or after the start of construction by reason or any litigation or other reason beyond the control of the Owner, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay; but time for completion of the work will be extended to such reasonable time as the Owner may determine will compensate for time lost by such delay with such determination to be set forth in writing.

51. Minimum Wages

All laborers and mechanics employed upon the work covered by this Contract shall be paid unconditionally and not less often than once each week, and without subsequent deduction or rebate on any account (except such payroll deductions as are made mandatory by law and such other payroll deductions as are permitted by the applicable regulations issued by the Secretary of Labor, United States Department of Labor, pursuant to the Anti-Kickback Act hereinafter identified), the full amount due at time of payment computed at wage rates not less than those contained in the wage determination decision of said Secretary of Labor (a copy of which is attached and herein incorporated by reference), regardless of any contractual relationship which may be alleged to exist between the Contractor or any subcontractor and such laborers and mechanics. All laborers and mechanics employed upon such work shall be paid in cash, except that payment may be by check if the employer provides or secures satisfactory facilities approved by the Local Public Agency or Public Body for the cashing of the same without cost or expense to the employee. For the purpose of this clause, contributions made or costs reasonably anticipated under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section 5.5 (a)(1)(IV) of Title 29, Code of Federal Regulations. Also for the purpose of this clause, regular contributions made or cost incurred for more than a weekly period under plans, funds, or programs, but covering the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

52. Underpayment of Wages or Salaries

In case of underpayment of wages by the Contractor or by any subcontractors to laborers or mechanics employed by the Contractor or subcontractor upon the work covered by this Contract, the Local Public Agency or Public Body in addition to such other rights as may be afforded it under this Contract shall withhold from the Contractor, out of any payments due the Contractor, so much thereof as the Local Public Agency or Public Body may consider necessary to pay such laborers or mechanics the full amount of wages required by this Contract. The amount so withheld may be disbursed by the Local Public Agency or Public Body, for and on account of the Contractor or the subcontractor (as may be appropriate), to the respective laborers or mechanics to whom the same is due or on their behalf to plans, funds, or programs for any type of fringe benefit prescribed in the applicable wage determination.

53. Anticipated Costs of Fringe Benefits

If the Contractor does not make payments to a trustee or other third person, he may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing fringe benefits under a plan or program of a type expressly listed in the wage determination decision of the Secretary of Labor which is a part of this Contract: provided, however, the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program. A copy of any findings made by the Secretary of Labor in respect to fringe benefits being provided by the Contractor must be submitted to the Local Public Agency or Public Body with the first payroll filed by the Contractor subsequent to receipt of the findings.

54. Overtime Compensation Required by Contract Work Hours and Safety Standards Act (76 Stat. 357-360: Title 40 U.S.C., Sections 327-332)

a. Overtime Requirements. No Contractor or subcontractor contracting for any part of the Contract work which may require or involve the employment of laborers or mechanics, including watchmen and guards, shall require or permit any laborer or mechanic in any workweek in which he is employed on such work to work in excess of 40 hours in such work week unless such laborer or mechanic receives compensation at a rate not less than one and one-half time his basic rate of pay for all hours worked in excess of 40 hours in such work week, as the case may be.

b. Violation: Liability for Unpaid Wages Liquidated Damages. In the event of any violation of the clause set forth in Paragraph (a), the Contractor and any subcontractor responsible therefore shall be liable to any affected employee for his unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violations of the clause set forth in Paragraph (a), in the sum of $10 for each calendar day on which such employee was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in Paragraph (a).

c. Withholding for Liquidated Damages. The Local Public Agency or Public Body shall withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor, such sums as may administratively be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for liquidated damages as provided in the clause set forth in Paragraph (b).

d. Subcontracts. The Contractor shall insert any subcontracts the clauses set forth in Paragraph (a), (b), and (c) of this Section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.

55. Employment of Apprentices/Trainees

a. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed and individually registered in a bona-fide apprenticeship program registered with the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeyman in any craft classification shall not be greater than the ratio permitted to the contractors to his entire work force under the registered program. Any employee listed on a payroll at any apprentice wage rate, who is not a trainee as defined in subdivision (b) of this subparagraph or is not registered or otherwise employed as stated above, shall be paid the wage rate determined by the Secretary of Labor for the classification of work he actually performed. The Contractor or subcontractor will be required to furnish to the contracting officer or a representative of the Wage-Hour Division of the U.S. Department of Labor written evidence of the registration of his program and apprentices as well as the appropriate ratios and wage rates (expressed in percentages of the journeyman hourly rates), for the area of construction prior to using any apprentices on the contract work. The wage rate paid apprentices shall be not less than the appropriate percentage of the journeyman's rate contained in the applicable wage determination.

b. Trainees. Except as provided in 29 CFR 5.15 trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification, by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training. Every trainee must be paid at not less than the rate specified in the

approved program for his level of progress. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Bureau of Apprenticeship and Training shall be paid not less than the wage rate determined by the Secretary of Labor for the classification of work he actually performed. The Contractor or subcontractor will be required to furnish the contracting officer or a representative of the Wage-Hour Division of the U.S. Department of Labor written evidence of the certification of his program, the registration of the trainees, and the ratios and wage rates prescribed in that program. In the event the Bureau of Apprenticeship and Training withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal Employment Opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 112246, as amended, as 29 CFR Part 30.

56. Employment of Certain Persons Prohibited

No person under the age of sixteen years and no person who, at the time, is serving sentence in a penal or correctional institution shall be employed on the work covered by this Contract.

57. Regulations Pursuant to So-Called “Anti-Kickback Act”

The Contractor shall comply with the applicable regulations (a copy of which is attached and herein incorporated by reference) of the Secretary of Labor, United States Department of Labor, made pursuant to the So-Called “Anti-Kickback Act” of June 13, 1934 (48 Stat. 948: 62 Stat. 862; Title U.S.C., Section 874: and Title 40 U.S.C. Section 276c), and any amendments or modifications thereof, shall cause appropriate provisions to be inserted in subcontracts to insure compliance therewith by all subcontractors subject thereto, and shall be responsible for the submission of affidavits required by subcontractors there under, except as said Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances, and exemptions from the requirements thereof.

58. Employment of Laborers or Mechanics Not Listed in Aforesaid Wage Determination Decision

Any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the Contract will be classified or reclassified conformably to the wage determination by the Local Public Agency or Public Body, and a report of the action taken shall be submitted by the Local Public Agency or Public Body, through the Secretary of Housing and Urban Development, to the Secretary of Labor, United States Department of Labor. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question accompanied by the recommendation of the Local Public Agency of Public Body shall be referred, through the Secretary of Housing and Urban Development, to the Secretary of Labor for final determination.

59. Fringe Benefits Not Expressed as Hourly Wage Rates

The Local Public Agency or Public Body shall require, whenever the minimum wage rate prescribed in the Contract for class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly wage rate and the Contractor is obligated to pay cash equivalent of such a fringe benefit, an hourly cash equivalent thereof to be established. In the event the interested parties cannot agree upon a cash equivalent of the fringe benefit, the question, accompanied by the recommendation of the Local Public Agency or Public Body, shall be referred, through the Secretary of Housing and Urban Development, to the Secretary of Labor for determination.

60. Posting Wage Determination Decisions and Authorized Wage Deductions

The applicable wage poster of the Secretary of Labor, United States Department of Labor, and the applicable wage determination decisions of said Secretary of Labor with respect to the various classification of laborers and mechanics employed and to be employed on the work covered by this

Contract, and a statement showing all deductions, if any, in accordance with the provisions of this Contract, to be made from wages actually earned by persons so employed or to be employed in such classifications, shall be posted at appropriate conspicuous points at the site of the work.

61. Complaints, Proceedings, or Testimony by Employees

No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this Contract to his employer.

62. Claims and Disputes Pertaining to Wage Rates

Claims and disputes pertaining to wage rates or to classifications of laborers and mechanics employed upon the work covered by this Contract shall be promptly reported by the Contractor in writing to the Local Public Agency or Public Body for referral by the latter through the Secretary of Housing and Urban Development to the Secretary of Labor, United States Department of Labor, whose decision shall be final with respect thereto.

63. Questions Concerning Certain Federal Statues and Regulations

All questions arising under this Contract which relate to the application or interpretation of (a) the aforesaid Anti-Kickback Act, (b) the Contract Work Hours and Safety Standards Act, (c) the aforesaid Davis-Bacon Act, (d) the regulations issued by the Secretary of Labor, United States Department of Labor, pursuant to said Acts, or (e) the labor standards provisions of any other pertinent Federal statute, shall be referred, through the Local Public Agency or Public Body and the Secretary of Housing and Urban Development, to the Secretary of Labor, United States Department of Labor, for said Secretary's appropriate ruling or interpretation which shall be authoritative and may be relied upon for the purposes of this Contract.

64. Payrolls and Basic Records of Contractor and Subcontractors

The Contractor and each subcontractor shall prepare his payrolls on forms satisfactory to and in accordance with instructions to be furnished by the Local Public Agency or Public Body. The Contractor shall submit weekly to the Local Public Agency or Public Body two certified copies of all payrolls of the Contractor and of the subcontractors, it being understood that the Contractor shall be responsible for the submission of copies of payrolls of all subcontractors. Each such payroll shall contain the "Weekly Statement of Compliance" set forth in section 3.3 of Title 29, Code of Federal Regulations. The payrolls and basic payroll records of the Contractor and each subcontractor covering all laborers and mechanics employed upon the work covered by this Contract shall be maintained during the course of the work and preserved for a period of 5 years thereafter. Such payrolls and basic payroll records shall contain the name and address of each such employee, his correct classification, rate of pay (including rates of contributions or costs anticipated of the types described by Section 1(b) (2) of the David-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. In addition, whenever the Secretary of Labor has found under Section 5.5 (a) (1) (iv) of Title 29, Code of Federal Regulations, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b) (2) (3) of the Davis-Bacon Act, the Contractor or subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. The Contractor and each subcontractor shall make his employment records with respect to persons employed by him upon the work covered by this Contract available for inspection by authorized representatives of the Secretary of Housing and Urban Development, the Local Public Agency or Public Body, and the United States Department of Labor.

Such representatives shall be permitted to interview employees of the Contractor or of any subcontractor during working hours on the job.

65. Specific Coverage of Certain Types of Work by Employees

The transporting of materials and supplies to or from the site of the Project or Program to which this Contract pertains by the employees of the Contractor or of any subcontractor, and the manufacturing or furnishing or materials, articles, supplies, or equipment on the site of the Project or Program to which this Contract pertains by persons employed by the Contractor or by any subcontractor, shall, for the purposes of this Contract, and without limiting the generality of the foregoing provisions of this Contract, be deemed to be work to which these Federal Labor Standard Provisions are applicable.

66. Ineligible Subcontractors

The Contractor shall not subcontract any part of the work covered by this Contract or permit subcontracted work to be further subcontracted without the Local Public Agency's or Public Body's prior written approval of the subcontractor. The Local Public Agency or Public Body will not approve any subcontractor for work covered by this Contract who is at the time ineligible under the provisions of any applicable regulations issued by the Secretary of Labor, United States Department of Labor or the Secretary of Housing and Urban Development, to receive an award of such subcontract.

67. Provisions to be Included in Certain Subcontracts

The Contractor shall include or cause to be included in each subcontract covering any of the work covered by this Contract, provisions which are consistent with these Federal Labor Standards Provisions and also a clause requiring the subcontractors to include such provisions in any lower tier subcontracts which they may enter into, together with a clause requiring such insertion in any further subcontracts that may in turn be made.

68. Breach of Foregoing Federal Labor Standards Provision

In addition to the causes for termination of this Contract as herein elsewhere set forth, the Local Public Agency or Public Body reserves the right to terminate this Contract if the Contractor or any subcontractor whose subcontract covers any of the work covered by this Contract shall breach any of these Federal Labor Standards Provisions. A breach of these Federal Labor Standards Provisions may also be grounds for debarment as provided by the applicable regulations issued by the Secretary of Labor, United States Department of Labor.

69. Employment Practices

The Contractor (1) shall, to the greatest extent practicable, follow hiring and employment practices for work on the project which will provide new job opportunities for the unemployed and underemployed; and (2) shall insert or cause to be inserted the same provision in each construction subcontract.

70. Contract Termination; Debarment

A breach of Section 45 and the Federal Labor Standards Provision, may be grounds for termination of the contract, and for debarment as provided in 29 CFR 5.6.

ATTACHMENT TO FEDERAL LABOR STANDARDS PROVISIONS

SO-CALLED "ANTI-KICKBACK ACT" AND REGULATIONS PROMULGATED

PURSUANT THERETO BY THE SECRETARY OF LABOR, UNITED STATES DEPARTMENT OF LABOR

TITLE 18, U.S.C., SECTION 374

(Replaces Section 1 of the Act of June 13, 1934 (48 Stat. 948, 40 U.S.C., Sec. 276b) pursuant to the Act of June 25, 1948, 62 Stat. 862)

Kickbacks from Public Works Employees

Whoever, by force, intimidation**,** or threat of procuring dismissal from employment, or by any other manner whatsoever induces any person employed in the construction, prosecution, completion or repair of any public building, public work, or building or work financed in whole or in part by loans or grants from the United States, to give up any part of the compensation to which he is entitled under his contract of employment, shall be fined not more than $5,000 or imprisoned not more than five years, or both

SECTION 2 OF THE ACT OF JUNE 13, 1934, AS AMENDED
(48 Stat. 948, 62 Stat. 262, 63 Stat. 108, 72 Stat. 967, 40 U.S.C., Sec. 276c)

The Secretary of Labor shall make reasonable regulations for contractors and subcontractors engaged in the construction, prosecution, completion or repair of public buildings, public works or buildings or works financed in whole or in part by loans or grants from the United States, including a provision that each contractor and subcontractor shall furnish weekly a statement with respect to the wages paid each employee during the preceding week. Section 1001 of Title 18 (United States Code) shall apply to such statements.

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Pursuant to the aforesaid Anti-Kickback Act, the Secretary of Labor, United States Department of Labor, has promulgated the regulations hereinafter set forth, which regulations are found in Title 29, Subtitle A, Code of Federal Regulations, Part 3. The term "this part" as used in the regulations hereinafter set forth, refers to Part 3 last above mentioned. Said regulations are as follows.

TITLE 29 – LABOR

Subtitle A – Office of the Secretary of Labor

Part 3 CONTRACTORS AND SUBCONTRACTORS ON PUBLIC BUILDING OR PUBLIC WORK FINANCED IN WHOLE OR IN PART BY LOANS OR GRANTS FROM THE UNITED STATES.

SECTION 3.1 PURPOSE AND SCOPE

This part prescribes “anti-kickback” regulations under Section 2 of the Act of June 13, 1934, as amended (40 U.S.C. 276c), popularly known as the Copeland Act. This part applies to any contract which is subject to Federal Wage standards and which is for the construction, prosecution, completion, or repair of public buildings, public works or buildings or works financed in whole or in part by loans or grants from the United States. The part is intended to aid in the enforcement of the minimum wage provisions of the Davis-Bacon Act and the various statutes dealing with Federally assisted construction that contain similar minimum wage provisions, including those provisions which are not subject to Reorganization Plan No. 14 (e.g., the College Housing Act of 1950, the Federal Water Pollution Control Act, and the Housing Act of 1959), and in the enforcement of the overtime provisions of the Contract Work Hours Standards Act whenever they are applicable to construction work. The part details the obligation of Contractors and subcontractors relative to the weekly submission of statements regarding the wages paid on work covered thereby; sets forth the circumstances and procedures governing the making of payroll deductions from the wages of those employed on such work; and delineates the methods of payment permissible on such work.

SECTION 3.2 DEFINITIONS

As used in the regulation in this part:

a. The terms “building” or “work” generally include construction activity as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work. The terms include, without limitation, buildings, structures, and improvements of all types, such as bridges, dams, plants, highways, parkways, streets, subways, tunnels, sewers, mains, power lines, pumping stations, railways, airports, terminals, docks, piers, wharves, ways, lighthouses, buoys, jetties, breakwaters, levees, and canals; dredging, shoring, scaffolding, drilling, blasting, excavating, cleaning, and landscaping. Unless conducted in connection with and at the site of such a building or work as is described in the foregoing sentence, the manufacture or furnishing of materials, articles, supplies, or equipment (whether or not a Federal or State agency acquires title to such materials, articles, supplies, or equipment during the course of the manufacture or furnishing, or owns the materials from which they are manufactured or furnished) is not a “building” or “work” within the meaning of the regulations in this part.

b. The terms “construction,” “prosecution,” “completion,” or “repair” mean all types of work done on a particular building or work at the site thereof, including, without limitation, altering, remodeling, painting and decorating, the transporting of materials and supplies to or from the building or work by the employees of the construction Contractor or construction subcontractor, and the manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the building or work, by persons employed at the site by the Contractor or subcontractor.

c. The terms “public building” or “public work” include building or work for whose construction, prosecution, completion, or repair, as defined above, a Federal agency is a contracting party, regardless of whether title thereof is in a Federal agency.

d. The term “building or work financed in whole or in part by loans or grants from the United States” includes building or work for whose construction, prosecution, completion, or repair, as defined above, payment or part payment is made directly or indirectly from funds provided by loans or grants by a Federal agency. The term does not include building or work for which Federal assistance is limited solely to loan guarantees or insurance.

e. Every person paid by a Contractor or subcontractor in any manner for his labor in the construction, prosecution, completion, or repair of a public building or public work or building or work financed in whole or in part by loans or grants from the United States is “employed” and receiving “wages” regardless of any contractual relationship alleged to exist between him and the real employer.

f. The term “any affiliated person” includes a spouse, child, parent, or other close relative or the Contractor or subcontractor; a partner or officer of the Contractor or subcontractor; a corporation closely connected with the Contractor or subcontractor as parent, subsidiary or otherwise, and an officer, or agent of such corporation.

g. The term “federal agency” means the United States, the District of Columbia, and all executive departments, independent establishments, administrative agencies, and instrumentalities of the United States and the District of Columbia, including corporations, all or substantially all of the stock of which is beneficially owned by the United States, by the District of Columbia, or any of the foregoing departments, establishments, agencies, and instrumentalities.

SECTION 3.3 WEEKLY STATEMENT WITH RESPECT TO PAYMENT OF WAGES

a. As used in this section the term “employee” shall not apply to persons in classifications higher than that of laborer or mechanic and those who are the immediate supervisors or such employees.

b. Each Contractor or subcontractor engaged in the construction, prosecution, completion, or repair of any public building or public work, or building or work financed in whole or in part by loans or grants from the United States, shall furnish each week a statement with respect to the wages paid each of its employees engaged on work covered by 29 CFR Parts 3 and 5 during the preceding weekly payroll period. This statement shall be executed by the Contractor or subcontractor or by an authorized officer or employee of the Contractor or subcontractor who supervises the payment of wages, and shall be on form WH 3-18, “Statement of Compliance”, or on an identical form on the back of WH 3-17 “Payroll (For Contractors Optional Use)”, or on any form with identical wording. Sample copies of WH 3-17 and WH 3-18 may be obtained from the Government contracting or sponsoring agency, and copies of these forms may be purchased by the Government Printing Office.

c. The requirements of this section shall not apply to any contract of $2,000.00 or less.

d. Upon a written finding by the head of a Federal agency, the Secretary of Labor may provide reasonable limitations, variations, tolerances, and exemptions from the requirements of the section subject to such conditions as the Secretary of Labor may specify.

(29 F.R. 95. Jan. 4, 1964, as amended at 33 F.R. 10186, July 17, 1968)

SECTION 3.4 SUBMISSION OF WEEKLY STATEMENTS AND THE PRESERVATION AND INSPECTION OF WEEKLY PAYROLL RECORDS

a. Each weekly statement required under 3.3 shall be delivered by the Contractor or subcontractor, within seven days after the regular payment date of the payroll period; to a representative of a Federal or State agency in charge at the site of the building or work, or if there is no representative of a Federal or State agency at the site of the building or work, the statement shall be mailed by the Contractor or subcontractor, within such time, to a Federal or State agency contracting for or financing the building or work. After such examination and check as may be made, such statement, or a copy thereof, shall be kept available, or shall be transmitted together with a report of any violation, in accordance with applicable procedures prescribed by the United States Department of Labor.

b. Each Contractor or subcontractor shall preserve his weekly payroll records for a period of five years from date of completion of the contract. The payroll records shall set out accurately and completely the name and address of each laborer and mechanic, his correct classification, rate of pay, daily and weekly number of hours worked, deductions made, and actual wages paid. Such payroll records shall be made available at all times for inspection by the contracting officer or his authorized representative, and by authorized representatives of the Department of Labor.

SECTION 3.5 PAYROLL DEDUCTIONS PERMISSIBLE WITHOUT APPLICATION TO OR APPROVAL OF THE SECRETARY OF LABOR

Deductions made under the circumstances or in the situations described in the paragraphs of this section may be made without application to and approval of the Secretary of Labor.

a. Any deductions made in compliance with the requirements of Federal, State, or local law, such as Federal or State withholding income taxes and Federal social security taxes.

b. Any deductions of sums previously paid to the employee as a bona fide prepayment of wages when such prepayment is made without discount or interest. A “bona fide prepayment of wages” is considered to have been made only when cash or its equivalent has been advanced to the person employed in such manner as to give him complete freedom of disposition of the advanced funds.

c. Any deduction of amounts required by court process to be paid to another, unless the deduction is in favor of the Contractor, subcontractor or any affiliated person, or when collusion or collaboration exists.

d. Any deduction constituting a contribution on behalf of the person employed to funds established by the employer or representatives of employees, or both, for the purpose for providing either from principal or income, or both, medical or hospital care, pensions or annuities on retirement, death benefits, compensation for injuries, illness, accidents, sickness, or disability, or for insurance to provide any of the foregoing, or unemployment benefits, vacation pay, savings accounts, or similar payments for the benefit of employees, their families and dependents: Provided, however, that the following standards are met: (1) the deduction not otherwise prohibited by law; (2) it is either: (i) voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of or for the continuation of employment, or (ii) provided for in a bona fide collective bargaining agreement between the Contractor or subcontractor and representatives of its employees; (3) no profit or other benefit is otherwise obtained, directly or indirectly, by the Contractor or subcontractor or any affiliated person in the form of commission, dividend, or otherwise; and (4) the deductions shall serve the convenience and interest of the employee.

e. Any deduction contributing toward the purchase of Untied States Defense Stamps and Bonds when voluntarily authorized by the employee.

f. Any deduction requested by the employer to enable him to repay loans to or to purchase shares in credit unions organized and operated in accordance with Federal and State credit union statues.

g. Any deduction voluntarily authorized by the employee for the making of contributions to governmental or quasi-governmental agencies, such as the American Red Cross.

h. Any deduction voluntarily authorized by the employee for the making of contributions to Community Chests, United Givers Funds, and similar charitable organizations.

i. Any deductions to pay regular union initiation fees and membership dues, not including fines or special assessments: Provided, however, that a collective bargaining agreement between the Contractor or subcontractor and representative of its employees provides for such deductions and the deductions are not otherwise prohibited by law.

j. Any deduction not more than for the “reasonable cost’ of board, lodging, or other facilities meeting the requirements of section 3 (m) of the Fair Labor Standards Act of 1938, as amended, and Part 531 of this title. When such a deduction is made the additional records required under 516.27 91) of this title shall be kept.

SECTION 3.6 PAYROLL DEDUCTIONS PERMISSIBLE WITH THE APPROVAL OF THE SECRETARY OF LABOR

Any Contractor or subcontractor may apply to the Secretary of Labor for permission to make any deduction not permitted under 3.5. The Secretary may grant permission whenever he finds that:

a. The Contractor, subcontractor, or any affiliated person does not make a profit or benefit directly or indirectly from the deduction either in the form of a commission, dividend, or otherwise;

b. The deduction is not otherwise prohibited by law;

c. The deduction is either (1) voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of employment or its continuance, or (2) provided for in a bona fide collective bargaining agreement between the Contractor or subcontractor and representatives of its employees; and

d. The deduction serves the convenience and interest of the employee.

SECTION 3.7 APPLICATIONS FOR THE APPROVAL OF THE SECRETARY OF LABOR

Any application for the making of payroll deductions under 3.6 shall comply with the requirements prescribed in the following paragraphs of this section:

a. The application shall be in writing and shall be addressed to the Secretary of Labor.

b. The application shall identify the contract or contracts under which the work in question is to be performed. Permission will be given for deductions only on specific, identified contract, except upon a showing of exceptional circumstances.

c. The application shall state affirmatively that there is compliance with the standards set forth in the provisions of 3.6. The affirmation shall be accompanied by a full statement of the facts indicating such compliance.

d. The application shall include a description of the proposed deduction, the purpose to be served thereby, and the classes of laborers or mechanics from whose wages the proposed deduction would be made.

e. The application shall state the name and business of any third person to whom any funds obtained from the proposed deductions are to be transmitted and the affiliation of such person, if any, with the applicant.

SECTION 3.8 ACTION BY THE SECRETARY OF LABOR UPON APPLICATIONS

The Secretary of Labor shall decide whether or not the requested deduction is permissible under provisions or 3.6, and shall notify the applicant in writing of his decision.

SECTION 3.9 PROHIBITED PAYROLL DEDUCTIONS

Deductions not elsewhere provided for by this part and which are not found to be permissible under 3.6 are prohibited.

SECTION 3.10 METHODS OF PAYMENT OF WAGES

The payment of wages shall be by cash, negotiable instruments payable on demand, or the additional forms of compensation for which deductions are permissible under this part. No other methods of payment shall be recognized on work subject to the Copeland Act.

SECTION 3.11 REGULATIONS PART OF CONTRACT

All contracts made with respect to the construction, prosecution, completion, or repair or any public building or public work or building or work finances in whole or in part by loans or grants from the United States covered by the regulations in this part shall expressly bind the Contractor or subcontractor to comply with such of the regulations in this part as may be applicable. In this regard, see 5.5 (a) of this subtitle.

U.S. Department of Housing and Urban Development

Supplemental General Conditions

1. Enumeration of Plans, Specifications and Addenda
2. Stated Allowances
3. Special Hazards
4. Public Liability and Property Damage Insurance
5. Photographs of Projects
6. Schedule of Minimum Hourly Wage Rates
7. Builder’s Risk Insurance
8. Special Equal Opportunity Provisions
9. Certification of Compliance with Air and Water Acts
10. Special Conditions Pertaining to Hazards, Safety Standards and Accident Prevention

8. Special Equal Opportunity Provisions

A. Activities and Contracts Not Subject to Executive Order 11246, as Amended

(Applicable to Federally assisted construction contracts and related subcontracts $10,000 and under)

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

1. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants for employment are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

2. The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices to be provided by Contracting Officer setting forth the provisions of this non-discrimination clause. The Contractor shall state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

3. Contractors shall incorporate foregoing requirements in all subcontracts.

B. Executive order 11246 (Contracts/subcontracts above $10,000)

1. Section 202 Equal Opportunity Clause

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

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

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

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

(4.) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5.) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Department and the Secretary of Labor for purposes of investigation, to ascertain compliance with such rules, regulations, and others.

(6.) In the event of the Contractor's non-compliance with the non-discrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7.) The Contractor will include the provisions of the sentence immediately preceding Paragraph (1) and the provision of Paragraph (1) through (7) in every subcontract or purchase order unless exempt by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provisions, including sanctions for non-compliance. Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Department the Contractor may request the United States to enter into such litigation to protect the interest of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: Provided, that if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of Contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor in obtaining the compliance of Contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a Contractor debarred from, or who has not demonstrated eligibility for Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation

of the equal opportunity clause as may be imposed upon Contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee), refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurances of future compliance have been received from such applicant, and refer the case to the Department of Justice for appropriate legal proceedings.

2. Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246). (Applicable to contracts/subcontracts exceeding $10,000.00)

1. The Offerer's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Goals for Minority Participation:	Goals for Female Participation:
12.7	6.9
Insert Goals:	Insert Goals for Current Year:

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographic area located outside of the covered area, it shall apply the goals established for such geographic area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and non-federally involved construction

The Contractor's compliance with the Executive Order and the regulation in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3 (a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county, and the city, if any).

3. Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)

1. As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs, United State Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or subcontractors failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in Paragraph 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

    a. Ensure and maintain a working environment free of harassment, intimidation and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

    b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

    c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

    d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources complied under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc., by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment sources, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractors' EEO policies and affirmative action obligations.

q. Covered construction Contractors performing contracts in geographical area where they do not have a federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the contract is being performed. Goals are published periodically in the Federal Register in notice form and such notices may be obtained from any office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through q). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through q of these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even thought the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in Paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall precede in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

C. Certification of Nonsegregated Facilities (Over $10,000)

By the submission of this bid, the bidder, offerer, applicant or subcontractor certifies that s/he does not maintain or provide for his/her employees any segregated facility at any of his/her establishments, and that s/he does not permit employees to perform their services at any location, under his/her control where segregated facilities are maintained. S/he certifies further that s/he will not maintain or provide for employees any segregated facilities at any of his/her establishments, and s/he will not permit employees to perform their services at any location under his/her control where segregated facilities are maintained. The bidder, offerer, applicant or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this proposed contract. As used in this certification, the term “segregated facilities” means any waiting rooms, work area, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms, and other storage or dressing areas, ***** transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion or national origin, because of habit, local custom, or otherwise. S/he further agrees that (except where s/he has obtained identical certifications from proposed subcontractors for specific time periods) s/he will obtain identical certification from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause; that s/he will retain such certification in his/her files; and that s/he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods).

***** Parking lots, drinking fountains, recreation or entertainment areas.

D. Section 3 – Contract Special Provisions Clause

The work to be performed under this contract is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3), contributes to the establishment of stronger, more sustainable communities by ensuring that employment and other economic opportunities generated by Federal financial assistance for housing and community development programs are, to the greatest extent feasible, directed toward low- and very low-income persons, particularly those who receive Federal financial assistance for housing and those residing in communities where the financial assistance is expended.

The parties to this contract agree to comply with HUD's regulations in 24 CFR part 75, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 75 regulations.

The contractor agrees to send to each labor organization or representative or workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this Section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the Section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

The Contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 75, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 75. The Contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 75.

The Contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the Contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 75 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 75.

Noncompliance with HUD's regulations in 24 CFR part 75 may result in sanctions, termination of this Contract for default, and debarment or suspension from future HUD assisted contracts.

9. Certification of Compliance with Air and Water Acts

(Applicable to Federally assisted construction contracts and related subcontracts exceeding $100,000)

Compliance with Air and Water Acts

During the performance of this contract, the Contractor and all subcontractors shall comply with the requirements of the Clean Air Act, as amended, 42 USC 1857 et seq., the Federal Water Pollution Control Act, as amended, 33 USC 1251 et seq., and the regulations of the Environmental Protection Agency with respect thereto, at 40 CFR Part 15, as amended

In addition to the foregoing requirements, all nonexempt Contractors and subcontractors shall furnish to the owner, the following:

(1.) A stipulation by the Contractor or subcontractors, that any facility to be utilized in the performance of any nonexempt contract or subcontract, is not listed on the list of Violating Facilities issued by the Environmental Protection Agency (EPA) pursuant to 40 CFR 15.20.

(2.) Agreement by the Contractor to comply with all the requirements of Section 114 of the Clean air Act, as amended (42 USC 1857 c-8) and Section 308 of the Federal Water Pollution Control Act, as amended, (33 USC 1318) relating to inspection, monitoring, entry, reports and information, as well as all other requirements specified in said Section 114 and Section 308, and all regulations and guidelines issued there under.

(3.) A stipulation that as a condition for the award of the contract, prompt notice will be given of any notification received from the Director, Office of Federal Activities, EPA, indicating that a facility utilized, or to be utilized for the contract, is under consideration to be listed on the EPA List of Violating Facilities.

(4.) Agreement by the Contractor that he will include, or cause to be included, the criteria and requirement in Paragraph (1) through (4) of this section in every nonexempt subcontract and requiring that the Contractor will take such action as the Government may direct as a means of enforcing such provisions.

10. Special Conditions Pertaining to Hazards, Safety Standards and Accident Prevention

A. Lead-Based Paint Hazards

(Applicable to contracts for construction or rehabilitation of residential structures)

The construction or rehabilitation of residential structures is subject to the HUD Lead-Based Paint regulations, 24 CFR Part 35. The Contractor and subcontractor shall comply with the provisions for the elimination of lead-based paint hazards under sub-part B of said regulations. The Owner will be responsible for the inspections and certifications required under section 35.14 (f) thereof.

B. Use of Explosives

When the use of explosives is necessary for the prosecution of the work the Contractor shall observe all local, state and Federal laws in purchasing and handling explosives. The Contractor shall take all necessary precaution to protect completed work, neighboring property, waterlines, or there underground structures. Where there is danger to structures or property from blasting, the charges shall be reduced and the material shall be covered with suitable timber, steel or rope mats.

The Contractor shall notify all owners of public utility property of intention to use explosives at least eight hours before blasting is done, close to such property. Any supervision or direction of use of explosives by the Engineer does not in any way reduce the responsibility of the Contractor or his Surety for Damages that may be caused by such use.

C. Danger Signals and Safety Devices (Modify as required)

The Contractor shall make all necessary precautions to guard against damages to property and injury to persons. He shall put up and maintain in good condition, sufficient red or warning lights at night, suitable barricades and other devices necessary to protect the public. In case the Contractor fails or neglects to take such precautions, the Owner may have such lights and barricades installed and charge the cost of this work to the Contractor. Such action by the Owner does not relieve the Contractor of any liability incurred under these specifications or contract.

D. Appendix 1 – Summary of Civil Rights Laws, Executive Orders and Regulations

The listing in Appendix 1 (to be inserted before wage rates) is applicable to all Federally assisted projects and are made a part of these Conditions.

Wage Rate Determination

Appropriate Wage Rates shall be inserted here.

Technical Specifications

Technical Specifications shall be inserted behind Wage Rates.

Attachment to Bid Specifications

In addition to the rules and regulations mentioned previously herein, the Contractor hereby is notified of the following requirements regarding civil rights.

Title VIII of the Civil Rights Act of 1968, as amended

Title VIII of the Civil Rights Act of 1968 provides that no person shall, on the basis of race, color, religion, national origin, handicap or familial status, be discriminated against in housing (and related facilities) provided with Federal assistance or leading practices with respect to residential property when such practices are connected with loans insured or guaranteed by the Federal Government.

Section 503 of Rehabilitation Act of 1973, as amended, provides for the nondiscrimination in Contractor employment. All recipients of Federal funds must certify to the following through all contracts issued:

Affirmative Action for Handicapped Workers

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

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

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

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

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

f. The Contractor will include the provisions of this clause in every subcontract or purchase order of $2,500 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontractor or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

Section 504 of the Rehabilitation Act of 1973, as amended, provides for nondiscrimination of an otherwise qualified individual solely on the basis of his/her handicap in benefiting from any program or activity receiving Federal financial assistance. All recipients must certify to compliance with all provisions of this Section.

Age Discrimination Act of 1975

No person in the United States shall, on the basis of age, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under, any program or activity receiving Federal financial assistance.

Section 912 of the Cranston-Gonzales National Affordable Housing Act amended Section 109 (a) of the HCD Act to prohibit discrimination on the basis of religion.

Kansas Act Against Discrimination

It is a policy of the State of Kansas that requires all employers, labor organizations, employment agencies, realtors, financial institutions, or other persons covered by this Act to assure equal opportunities and encourage every citizen regardless of race, religion, color, sex, age, physical disability, national origin, or ancestry, to secure and hold – without discrimination, segregation, or separation – employment in any field of work or labor for which they are properly qualified, the opportunity for full and equal public accommodations, and to assure full and equal opportunities in housing.

SUMMARY OF CIVIL RIGHTS LAWS, EXECUTIVE ORDERS, AND REGULATIONS

CDBG grantees must ensure all project activities will be administered in compliance with all civil rights laws and regulations. The following are summaries of those parts of the civil rights laws and regulations applicable to CDBG activities.

Title VI of the Civil Rights Act of 1964 provides that no person in the United States shall, on the grounds of race, color or national origin, be excluded from participation in, be denied benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.

Title VIII of the Civil Rights Act of 1968 (Fair Housing Act), as amended, prohibits discrimination in the sale, rental and financing of dwellings based on race, color, religion, sex or national origin. Title VIII was amended in 1988 (effective March 12, 1989) by the Fair Housing Amendments Act, which: expanded the coverage of the Fair Housing Act to prohibit discrimination based on disability or on familial status (presence of child under age of 18, and pregnant women); established new administrative enforcement mechanisms with HUD attorneys bringing actions before administrative law judges on behalf of victims of housing discrimination; and revised and expanded Justice Department jurisdiction to bring suit on behalf of victims in Federal district courts.

Section 109, Housing and Community Development (HCD) Act of 1974, as amended, provides that no person in the United States shall, on the grounds of race, color, national origin, religion, or sex, be excluded from participation in, be denied the benefits of or be subjected to discrimination under any program or activity funded in whole or in part with funds made available under Title I of the Housing and Community Development Act of 1974.

Section 504 of the Rehabilitation Act of 1973, as amended, provides for nondiscrimination of an otherwise qualified individual solely on the basis of his/her handicap in benefiting from any program or activity receiving federal financial assistance. All recipients must certify to compliance with all provisions of this Section.

Age Discrimination Act of 1975. No person in the United States shall, on the basis of age, be excluded from participation in, be denied the benefits of or subjected to discrimination under, any program or activity receiving federal financial assistance.

Executive Order 11063, as amended, directs all departments and agencies to take all action necessary and appropriate to prevent discrimination in housing and related facilities owned or operated by the federal government or provided with federal financial assistance and in the lending practices with respect to residential property and related facilities (including land to be developed for residential use) of lending institutions, insofar as such practices relate to loans insured or guaranteed by the federal government.

Kansas Act Against Discrimination. It is a policy of the State of Kansas that requires all employers, labor organizations, employment agencies, realtors, financial institutions, or other persons covered by this Act to assure equal opportunities and encourage every citizen regardless of

race, religion, color, sex, age, physical disability, national origin, or ancestry, to secure and hold – without discrimination, segregation, or separation – employment in any field of work or labor for which they are properly qualified, the opportunity for full and equal public accommodations, and to assure full and equal opportunities in housing.

Section 3 of the Housing and Urban Development Act of 1968, as amended, provides that, to the greatest extent feasible, opportunities for training and employment shall be given to recipients of public housing and lower income residents of the unit of local government or the metropolitan area (or non-metropolitan county) in which the project is located, contract work in connection with such projects shall be awarded to business concerns which are owned in substantial part by persons residing in the same metropolitan area (or non-metropolitan county) as the project, employ Section 3 residents in full-time positions, or subcontract with businesses which provide economic opportunities to lower income persons.

Executive Order 11246, as amended, provides that no person shall be discriminated against on the basis of race, color, religion, sex or national origin in any phase of employment during the performance of federal or federally-assisted construction contracts in excess of $10,000. The following civil rights requirements also apply to CDBG grantee performance: grantees shall comply with Executive Order 11246, as amended by Executive Order 12086, and the regulations issued pursuant thereto (41 CFR Chapter 60) which provide that no person shall be discriminated against on the basis of race, color, religion, sex, sexual orientation, gender identity or national origin in all phases of employment during the performance of federal or federally-assisted construction contracts. As specified in Executive Order 11246 and the implementing regulations, contractors and subcontractors on federal or federally assisted construction contracts shall take affirmative action to ensure fair treatment in employment, upgrading, demotion or transfer, recruitment or retirement advertising, layoff or termination, rates of pay or other forms of compensation and selection or training and apprenticeship.

Section 503 of the Rehabilitation Act of 1973, as amended, provides for the nondiscrimination in contractor employment. All recipients of federal funds must certify to the following through all contracts issued:

Affirmative Action for Handicapped Workers

1. The contractor will not discriminate against any employee in regard to any position for which the employee or applicant for employment is qualified. The contractor agrees to make affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: Employment upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeships.
2. The contractor agrees to comply with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.
3. In the event of the contractor's noncompliance with the requirements of this clause, action for noncompliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.

4. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in the form to be prescribed by the Director, provided by or through the contracting officer. Such notices shall state the contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment and the rights of applicants and employees.
5. The contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.
6. The contractor will include the provisions of this clause in every subcontract or purchase order of $2,500 or more unless exempted by rules, regulations or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontractor or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

Section 912 of the Cranston-Gonzales National Affordable Housing Act, as amended, Section 109 (a) of the HCD Act to prohibit discrimination on the basis of religion.

E-Verify - CFR 52.222-54 requires federal contracts committing government contractors (subcontractors) to use the USCIS E-Verify system to verify that all of the contractors employees, (existing and new), directly performing work under federal contracts, are authorized to work in the United States.

E-Verify Contract Language for New Agreements:

Contract Clause:

Vendor/Contractor shall utilize the U.S. Department of Homeland Security's E-Verify system to confirm the employment eligibility of all persons employed by the Vendor/Contractor during the term of the Contract to perform employment duties within Kansas and all persons, including subcontractors, assigned by the Vendor/Contractor to perform work pursuant to the contract with the client.

E-VERIFY

Project No: _____

City/County of _____

Project Description: _____

_____

Vendor/Consultant acknowledges and agrees to the following:

Vendor/Consultant shall utilize the U.S. Department of Homeland Security's E-Verify system, in accordance with the terms governing use of the system, to confirm the employment eligibility of;

1. all persons employed by the Vendor/Consultant during the term of the Contract to perform employment duties within Kansas; and

2. all persons, including subcontractors, assigned by the Vendor/Consultant to perform work pursuant to the contract with the client.

Company/Firm: _____

Authorized Signature: _____

Title: _____

Date: _____

ADDITIONAL SUPPLEMENTARY CONDITIONS OF THE CONTRACT

1. WARRANTY
   a. Contractor warrants to Owner and Architect that on receipt of notice from either of them, within the period of one (1) year following date of Substantial Completion, that defects in materials and/or workmanship have appeared in the Work, Contractor will promptly correct such defects to the state of condition originally required by the Contract Documents at Contractor's expense.

2. SHOP DRAWINGS
   a. The Contractor shall submit **one (1) electronic copy** of all Shop or Setting Drawings and Schedules required for the work of the various trades, after same have been checked and compared with the Contract Document Requirements, and after checking with field conditions at the job and so certified on the Drawings by the Contractor. Above Drawings will not be checked by Architect unless same bear certification.
   b. Architect's approval is subject to notations on Drawings, Compliance with Drawings and Specifications, and conditions and measurements at project. Measurements and quantity not checked or approved.

3. CLEAN UP
   a. Each Contractor shall, at all times, remove any and all of his rubbish from the buildings and grounds and keep the building site clean.
   b. In addition to the general broom cleaning, the General Contractor shall hire **professional cleaners** to do the following cleaning for all trades at the completion of the work so that the facility is **"move-in ready"**:
      1) Glass. Remove putty, stains and paint from all glass and wash and polish same. Care shall be taken not to scratch the glass.
      2) Painted, Decorated, and Stained Work. Remove all marks, stains, fingerprints and other soil or dirt from all painted, decorated, and stained work.
      3) Temporary Protection. Remove all temporary protections; clean and polish all floors at completion.
      4) Woodwork. Clean and polish all woodwork upon completion.
      5) Hardware. Clean and polish all hardware for all trades. This shall include removal of all stains, dust, dirt, paint, etc., upon completion.
      6) Tile Work. Remove all spots, soil, and paint from all tile work, wash same upon completion.
      7) Fixtures and Equipment. Clean all fixtures and equipment, removing all stains, paint, dirt and dust.
   c. All combustible rubbish, and all debris and other rubbish shall be removed entirely from the premises.

4. MUTUAL RESPONSIBILITY OF CONTRACTORS
   a. General Contractor shall assume general coordination and direction of the project. General Contractor shall cooperate with Mechanical and Electrical Contractors and other subcontractors and/or suppliers on the Work and install their work in sequence to facilitate and not delay the completion of the project. The Architect is not the coordinator or expeditor of the work of the contractors and/or subcontractors referred to hereinbefore.

5. CHANGES IN THE WORK
   a. Whenever a Change Order involves net cost decrease, the CREDIT to the Owner shall be such net cost decrease. Whenever a Change Order involves a summary net increase, the Contract shall be increased by the amount of such net cost increase plus 10% of such net cost for overhead and profit. The General Contractor will furnish supervision and coordination for 10% of the cost of additional Mechanical and Electrical work ordered by the Owner.
   b. The Contractor shall furnish the Owner an itemized accounting with supporting data used in computing the value of any change that might be ordered.
   c. Change Orders must state a number of added days or days to be deleted from completion time. If no change in days is required by the change order, write NONE. Failure to comply with above voids any later request for extra time.

6. APPLICATION FOR PROGRESS PAYMENTS AND CERTIFICATION FOR PAYMENT
   a. On or before the 25th day of each month, the Contractor shall submit to the Architect an itemized Application for Payment supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require.
   b. If the Contractor has made application for payment as above, the Architect will, with reasonable promptness and within seven (7) days after receipt of the application, issue an application for payment to the Owner, with a copy to the Contractor in the amount of 90% of the value of the Contract the

Architect determines has been completed to the date of application, thus a 10% retainage, less any amount paid to the Contractor, or state in writing their reason for withholding an application.

c. Date of payment of the Application for Payment by the Owner is hereby defined as the earliest possible date that the Owner can prepare vouchers after receipt of Application for Payment from the Architect and approval of same by any governing body of the Owner and issuance of vouchers to cover Application for Payment.

7. CONTRACTOR'S LIABILITY INSURANCE
   a. Workers' Compensation and Employers Liability Insurance
   b. Bodily Injury and Property Damage - Limits shall be as follows:
      (1) Limits of liability coverage shall be $1,000,000.00 Combined Single Limit for Bodily Injury and Property Damage.

8. PROPERTY INSURANCE MARINE ALL RISK SPECIAL BUILDERS RISK AND TRANSIT FORM
   a. Until the Work is completed and accepted by the Owner, **the Contractor shall effect and maintain total Property Insurance (Marine All Risk Special Builders Risk and Transit Form**) upon the Work at the site to 100% of the insurable value thereof (plus 8% of this insured value for Architect's Fee in connection with any loss covered by this insurance) including items of labor and materials connected therewith in or adjacent to the structure insured, materials in place or to be used as a part of the permanent construction, including surplus materials, shanties, protective fences, bridges or temporary structures, miscellaneous materials and supplies incidental to the Work, and such scaffoldings, stagings, towers, forms and equipment as are not owned or rented by the Contractor, the cost of which is included in the cost of the work. EXCLUSIONS: This insurance does not cover any tools owned by mechanics; any tools, equipment, scaffoldings, stagings, towers and forms owned or rented by the Contractor; the capital value of which is not included in the cost of the work, nor loss of equipment, materials, tools, etc., by theft. **Contractor shall not commence construction prior to providing copy of policy to the Architect.**
   b. This insurance shall include the interest of the Owner, the Contractor, Subcontractor, and Sub-Subcontractor in the Work.

9. PERFORMANCE AND PAYMENT BONDS
   a. Bond shall be equivalent to AIA Form A311, two-part Performance Bond and Labor and Materials Bond with amount shown on each part equal to 100% of the total amount payable by the terms of the Contract. Surety shall be company licensed to do business at the place of building and shall be acceptable to the Owner.

END OF SECTION

LIST OF DRAWINGS

General

Cover
CFP.1 Code Footprint
CFP.2 Alternate #1: Code Footprint
ADA ADA Diagrams

Architectural

A1.1 Photographs
A1.2 Photographs
A1.3 Photographs
A2.1 First Floor Plans
A2.2 Second Floor Plans
A2.3 Basement Plans
A2.4 Alternate #1: First Floor Plans
A2.5 Alternate #1: Second Floor Plans
A2.6 Alternate #1 & #2: Basement Plans:
A3.1 Demolition - Exterior Elevations
A3.2 Exterior Elevations
A6.1 Ramp, Stair & Elevator Shaft Sections
A6.2 Alternate #1: Elevator/Stair Sections
A6.3 Alternate #1: Stair Sections
A7.1 Reflected Ceiling Plans
A7.2 Alternate #1: Reflected Ceiling Plans
A8.1 Enlarged Restroom Plans & Elevations
A8.2 Interior Elevations
A8.3 Alternate #1: Interior Elevations
A9.1 Kitchen Casework, Wainscot, Ceiling Beam, Perimeter Ceiling Drop Soffit Details
A10.1 Room Finish, Door, Window Schedules and Details
A10.2 Door Details

Structural

S0.1 General Notes
S0.2 Masonry Reinforcing Details
S2.0 Foundation Plans
S2.1 First Floor Framing Plans
S2.2 Second Floor Framing Plans
S2.3 Roof Framing Plans
S4.1 Ramp, Stair & Elevator Shaft Sections
S4.2 Alternate #1: Elevator/Stair Section & Details
S4.3 Alternate #1: Stair Sec

Plumbing

P0.1 Plumbing General Notes
P1.1 Waste & Vent Plans
P2.1 Domestic Water & Gas Plans
P6.1 Schedules and Diagrams
P9.1 Waste & Vent Riser Diagram

Mechanical

M0.1 Mechanical General Notes
M1.1 Basement & First Floor HVAC Plans
M1.2 Second Floor HVAC Plan
M6.1 HVAC Schedules

Electrical

E0.1 Electrical General Notes
E1.1 Basement & First Floor Lighting Plans
E1.2 Second Floor Lighting Plans
E2.1 Basement & First Floor Power Plans
E2.2 Second Floor Power Plan
E6.1 Light Fixture Schedule
E6.2 Panel Schedules & Riser Diagram

Attachment A

Kansas Legislature

44-1030
Chapter 44 – LABOR AND INDUSTRIES
ARTICLE 10. – KANSAS ACTS AGAINST DISCRIMINATION

44-1030 State and local government contracts; mandatory provisions.

(a) Except as provided by subsection (c), every contract for or on behalf of the state or any county or municipality or other political subdivision of the state, or any agency of or authority created by any of the foregoing, for the construction, alteration or repair of any public building or public work or for the acquisition of materials, equipment, supplies or services shall contain provisions by which the contractor agrees that:

(1) The contractor shall observe the provisions of the Kansas act against discrimination and shall not discriminate against any person in the performance of work under the present contract because of race, religion, color, sex, disability, national origin or ancestry;

(2) in all solicitations or advertisements for employees, the contractor shall include the phrase, "equal opportunity employer," or a similar phrase to be approved by the commission;

(3) if the contractor fails to comply with the manner in which the contractor reports to the commission in accordance with the provisions of K.S.A. 44-1031 and amendments thereto, the contractor shall be deemed to have breached the present contract and it may be canceled, terminated or suspended, in whole or in part, by the contracting agency;

(4) if the contractor is found guilty of a violation of the Kansas act against discrimination under a decision or order of the commission which has become final, the contractor shall be deemed to have breached the present contract and it may be canceled, terminated or suspended, in whole or in part, by the contracting agency; and

(5) the contractor shall include the provisions of subsections (a) (1) through (4) in every subcontract or purchase order so that such provisions will be binding upon such subcontractor or vendor.

(b) The Kansas human rights commission shall not be prevented hereby from requiring reports of contractors found to be not in compliance with the Kansas act against discrimination.

(c) The provisions of this section shall not apply to a contract entered into by a contractor;

(1) Who employs fewer than four employees during the term of such contract; or

(2) Whose contracts with the governmental entity letting such contract cumulatively total $5,000 or less during the fiscal year of such governmental entity.

History: L. 1972, ch. 194, § 14 : L. 1977, ch. 183 § 1; L. 1991, ch. 147, § 17; L. 1992, ch. 91, § 3; April 23.

SAMPLE COPY - STATUTORY BOND

Two (2) copies of Statutory Bond with Power of Attorney attached shall be furnished to architect prior to start of construction. Wording of Statutory furnished shall be equivelant of the sample on SB-2.

STATUTORY BOND

KNOW ALL MEN BY THESE PRESENTS:
_____, as Principal, and

_____, a Corporation organized under the laws of the State of _____, as Surety are held and firmly bound unto the State of _____ _____, in the penal sum of _____ _____Dollars $_____ lawful money of the United States, for the payment of which sum well and truly made, said Principal and Surety bind themselves, their heirs, administrators, executors, successors and assignees, jointly and severally by these presents.

Signed, sealed and delivered on this _____ day of _____ , 20 _____

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH THAT WHEREAS said Principal has entered into a written contract with _____ _____, hereinafter called the "Owner" dated _____ 20_____, for the construction or marking of the following described improvements:

all in accordance with the detailed Drawings and Specifications on file in the office of the Owner.

NOW THEREFORE, if the said Principal or the Subcontractor, or Sub-Subcontractors, of said Principal shall pay all indebtedness incurred for supplies, materials or labor furnished, used or consumed in connection with, in or about the construction or making of the above described improvements, including gasoline, lubrications, oils, fuel oils, greases, coat and similar items used or consumed directly in furtherance of such improvements, this obligation shall be void, otherwise it shall remain in full force and effect.

The said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or additions to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect any such change, extension of time, alteration or addition to the terms of the Contract or to the Specifications.

(SEAL)

_____
Principal
By: _____

(SEAL)

_____
Surety
By: _____

SECTION 01010

GENERAL WORK REQUIREMENTS

1. GENERAL
Should conflict occur between these General Work Requirements and the General Conditions, the requirements of this Section take precedence.

2. INTENT OF DOCUMENTS
The Contract Drawings are complementary and what is called for by anyone shall be as binding as if called by all. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work.

3. MANUFACTURER'S DIRECTIONS
All manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturers, unless herein specified to the contrary.

4. COOPERATION - CONTRACTOR WITH OWNER
It shall be clearly understood that the Owner reserves the right to install various equipment in the building prior to completion and acceptance, and it shall be the duty of the Contractor to cooperate with the Owner's employees rendering such assistance and so arranging his work that the entire project will be delivered complete in the best possible condition when required.

5. BUILDING PERMIT
As stated in Subparagraph 4.7.1, AIA DOCUMENT A201, General Conditions, the General Contractor shall secure and pay for the building permit.

6. CONSTRUCTION COORDINATION
   A. Before starting construction, a meeting shall be held with Contractor(s), Architect, and Consulting Engineers in attendance to plan and coordinate the schedule of construction and to review intent of Contract Documents. Contractor(s) shall follow instructions received at meeting in prosecuting the Work.

7. MATERIALS - EQUIPMENT - SUBSTITUTION
   A. In general, these Specifications identify the required materials and equipment by naming one or more manufacturers, brand, model, catalog number, and/or other identification; the first-named manufacturers product used as a basis for design; the other named brands considered equivalent. Equivalent brand manufacturers named must furnish products consistent with the Specifications for the first-named product, as determined by the Architect. Base Bid shall include only those brands named and must be used on the project, except as hereinafter provided.
   B. Materials or equipment specified exclusively, Base Bid shall be based on same and used on project, except as hereinafter provided.
   C. Prior to receipt of bids, should Contractor wish to incorporate in Base Bid, brands or products other than those named in the Specifications, he shall submit written request for substitution to Architect not later than seven (7) days prior to date bids are due. Architect will consider request and items approved will be listed in an addendum issued to all bidders.
   D. After execution of Contract, substitution of product brands for those named in the Specifications will be considered, only if request is received within thirty (30) days after Contract Date and request includes showing credit due Owner.
   E. Materials specified equivalent and those proposed for substitution must be equal or better than first-named material in construction, efficiency, utility, aesthetic design, physical size shall not be larger than space provided for it. Request for substitution by full description and technical data in two (2) copies, including manufacturer's name, model, catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information for comparison.
   F. Owner reserves the right:
      1) To require any or all bidders, before execution of Contract, to state what materials they will use.
      2) To require "if bound with the Bid Form," the Contractor to fill out a BID SUPPLEMENT listing the BASE BID and "ADD" or "DEDUCT" for other materials he proposes to use.

8. APPROVAL OF SUBCONTRACTORS – MATERIALS

A. The Contractor, if requested, must submit for approval before signing Agreement, list of Subcontractors and material suppliers enumerating items of work to be performed, name of materials, equipment, etc., to be furnished and/or installed. Refer to Paragraph - MATERIALS - EQUIPMENT - SUBSTITUTION.

B. If the list is not requested prior to signing of Agreement, list, as described in previous paragraph, shall be furnished within ten (10) days of signing Agreement.

9. PROTECTION - Supplement, ARTICLE 10, AIA GENERAL CONDITIONS

A. Refer to Paragraph - WEATHER CONDITIONS.

B. Each Contractor shall assume responsibility for his materials stored on the premises.

C. General Contractor shall take charge and assume general responsibility for proper protection of project during construction.

D. The General Contractor shall protect trees, shrubs, lawns, and all landscape from damage, providing guards and covering. Damaged work shall be repaired or replaced at his expense. Protect streets and sidewalks and make repairs at his expense.

1) Water Protection. The General Contractor shall, at all times, protect the excavation, trenches, and/or the building from damage by rain water, spring water, ground water, backing up of drains or sewers and all other water. He shall provide all pumps and equipment and enclosures to provide this protection.

2) Temporary Drainage. The General Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep the excavation free of water.

3) Snow and Ice. The General Contractor shall remove all snow and ice from public sidewalks and from the building, as may be required for the proper protection and/or prosecution of the Work.

4) Bracing, Shoring, and Sheeting. The General Contractor shall provide all shoring, bracing and sheeting as required for safety and for the proper execution of the work and have same removed when the work is completed.

5) Guard Lights. The General Contractor shall provide and maintain guard lights at all barricades, railings, obstructions in the streets, roads or sidewalks and at all trenches or pits adjacent to public walks or roads.

6) Weather Conditions. The General Contractor shall, at all times, provide protection against weather; rain, winds, storms, frost, or heat, so as to maintain all work, materials, apparatus, and fixtures, free from injury or damage. At the end of the day's work, all new work likely to be damaged shall be covered.

10. WEATHER CONDITIONS

The Contractor shall protect all portions of his work and all materials, at all times from damage by water, freezing, frost and is to repair, replace and make good to the satisfaction of the Architect, any portion of same which may in the Architect's opinion, have been damaged by the elements.

11. GRADES, LINES, LEVELS, AND SURVEYS

The Owner will establish the lot lines, restrictions and a bench mark. All other grades, lines, levels, and bench marks shall be established and maintained by the General Contractor, who shall be responsible for same. The General Contractor shall verify all grades, lines, levels, and dimensions as shown on the Drawings and he shall report all errors or inconsistencies in the above to the Architect before commencing work.

A. The General Contractor shall provide and maintain well-built batter boards at all corners. He shall establish bench marks in not less than two (2) widely separated places. As the work progresses, he shall establish bench marks at each floor, giving exact levels of the various floors.

B. As the work progresses, the General Contractor shall lay out in the forms and the rough flooring the exact location of all partitions as a guide to all trades.

C. The General Contractor shall verify all grades, lines, levels, and dimensions as shown on the Drawings and he shall report any errors or inconsistencies in the above to the Architect before commencing work.

12. USE OF COMPLETED PORTIONS

The Owner reserves the right to take possession of and use any completed or partially completed portions of the building, and further reserves the right to install equipment and facilities which are not a part of the Contract, notwithstanding the fact that the time of completion of entire work or portions thereof may not have expired; but such taking possession or installation of facilities shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents. The Owner, in taking possession of completed portions or installing such equipment, and facilities, shall do so at his own expense any damage which may occur either directly or indirectly by reason of such action.

A. Building Completion-Occupancy. Owner reserves the right to occupy building when the time for completion of work as stipulated in Contract has been reached, even though all parts of the work have not been completed and accepted by Owner. All work, including heating, electrical, and water service, will be discontinued only to Owner schedule.

B. Limit of Contract is not confined to any particular area of the site, but includes any area required to perform work shown on the Drawings and/or specified in these Specifications.

13. REQUIREMENTS IMMEDIATELY AFTER EXECUTION OF CONTRACT

Immediately after execution of the Contract, the Contractor shall deliver to the Architect the following items which are described more fully in following Articles:

Schedule of Values
Schedule of Operations
Progress Charts
Samples
Superintendent's name and resume of experience
List of Subcontractors and Material Suppliers

A. Schedule of Values on AIA Form G702, or other form approved by the Architect, a detailed breakdown of the Contract Sum indicating the amounts allotted to the various divisions of the work for labor and material. The schedule will serve as a guide to the Architect in determining the amounts due each month as the work progresses. The schedule shall be broken down as directed by the Architect.

B. Schedule of Operations based on the above Schedule of Values and indicating the progress of the work up to the first day of each month shall be prepared by the Contractor in a form approved by the Architect and shall be delivered to the Architect in duplicate with each application for payment.

C. Progress Charts based on the above specified schedule of operations and indicating the progress of the work up to the first day of each month shall be prepared by the Contractor in a form approved by the Architect and shall be delivered to the Architect in duplicate with each application for payment. Progress charts shall be in the form of a bar graph.

14. CONSTRUCTION PROCEDURE AND PHASING

A. Each Contractor shall schedule his work so as to cause a minimum of interference with business operations during all of the construction work.

B. In-Use Areas. Construction work within areas immediately adjacent to existing in-use areas shall be coordinated with the Owner, so that work is accomplished during periods of light occupancy of the areas and cause the least disturbance. Work in and adjacent to in-use areas shall be prosecuted by methods that will create the last amount of noise. Work shall be prefabricated away from office areas when practical to do so. New facilities shall be ready for use prior to disturbing existing areas.

C. Precautions and Cooperation

1) Notify the Owner 7 days in advance before any utility (natural gas, water, electricity, or sewer) is to be interrupted.

2) With proper notification, interruption in utilities up to 4 hours will be permitted without special provisions by the Contractor. *If any interruption of a utility exceeds 4 hours the Contractor must make arrangements for temporary alternate utility service.

3) Interruption of utilities must be coordinated with the Owner with changeovers and out of service at night. Weekend and evening changeovers of utilities shall occur with no additional cost to the Owner.

4) Openings to be cut in existing exterior walls must be saw cut. No jackhammer work will be permitted. Notify the Owner 7 days in advance of cutting of exterior walls.

15. TIME EXTENSIONS ADVERSE WEATHER

A. The Contractor shall comply with all provisions of the General Conditions in submitting any request for extension of Contract Time due to unusually severe weather.

B. Definitions:

1. Adverse Weather - Atmospheric conditions at a definite time and place which are unfavorable to construction activities.
2. Unusually Severe Weather - Weather which is more severe than the adverse weather anticipated for the season, location, or activity involved.

C. In order for any request of time extension due to unusually severe weather to be valid, the Contractor must document both of the following conditions.

1. The weather experienced at the project site during the Contract period is more severe that the adverse weather anticipated for the project location during any given month.
2. The unusually severe weather actually caused a delay to the completion of the project. The delay must be beyond the control and without fault or negligence by the Contractor.

D. The following schedule of monthly anticipated adverse weather delays will constitute the baseline for monthly weather time evaluations. The Contractor's Progress Schedule must reflect these anticipated adverse weather delays in all weather affected activities:
MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON FIVE (5) DAY WORK WEEK.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5	4	7	8	10	9	8	8	7	5	4	4

END OF SECTION 01010

SECTION 01019

SPECIAL PROVISIONS

1. GENERAL
Should conflict occur between these Special Provisions and the General Conditions, the requirements of the Special Provisions shall take precedence.

2. TIME OF CONSTRUCTION – PENALTY CLAUSE
   a. Time of Construction - The Contractor will commence the work within ten (10) days after the Architect shall have given the Contractor written notice to commence construction to the satisfaction of the Owner within the calendar days as Contractor so stated in their Bid Form. The time for completion herein set forth shall be extended for the period of any reasonable delay which is due exclusively to causes beyond the control and without the fault of the Contractor, including acts of God, fires, floods, and direction by the Architect. It is impractical to perform any operation of construction and acts of omissions of the Owner with respect to matters for which Owner is solely responsible; provided, however, that no such extension of time for completion shall be granted the Contractor, unless within ten (10) days after the happening of any event relied upon by the Contractor for such extension of time, the Contractor shall have made a request, therefore, in writing to the Architect. Extended time will be submitted with pay request for Owner's approval.

   b. Penalty Clause - The time of completion of the construction of the project is of the essence of this Contract. Should the Contractor neglect, refuse, or fail to complete the project (100%) within the time herein agreed upon, after giving effect to extensions of time, if any, herein provided; the Owner shall have the right to deduct from and retain out of such money, which may then be due or which may become due and payable to the Contractor, the sum of THREE HUNDRED DOLLARS ($300.00) per day for each and every day that such construction is delayed in its completion beyond the specified time. If the amount due and to become due from the Contractor to the Owner is insufficient to pay in full any such liquidated damages, the Contractor shall pay to the Owner the amount necessary to effect such payment in full; provided, however, that the Owner shall promptly notify the Contractor in writing of the manner in which the amount retained, deducted or claimed. No award is given to the Contractor for early completion.

   c. Joint Responsibility - The General Contractor and/or Subcontractors causing the delay in completion of the project shall be responsible for payment of the penalty. In no case shall the total penalty for all contracts exceed the sum of daily penalty multiplied by the number of days of delay in completion.

3. ALTERNATES - Refer to Alternate Schedule, Section 01030
   a. Alternates specified are not a part of Base Bid, but are Alternates to same, their acceptance being at option of Owner.

4. CASH ALLOWANCES
   a. Costs included in Allowances: Cost of Product to Contractor or Subcontractor, less applicable trade discounts, delivery to site, except those taxes saved by use of Owner's tax exemption.
   b. Costs Not Included in the Allowance: Fees for overhead and profit, product handling at the site, including unloading, uncrating, and storage; protection of Products from elements and from damage and labor for installation and finishing.
   c. Architect Responsibilities:
      1. Consult with Contractor in consideration and selection of Products, suppliers and installers.
      2. Select Products in consultation with Owner and transmit decision to Contractor.
      3. Prepare Proposal Requests and Change Orders.
   d. Contractor Responsibilities:
      1. Assist Architect/Engineer in selection of Products, suppliers and installers.
      2. Obtain proposals from suppliers and installers and offer recommendations.
      3. On notification of selection by Architect, execute purchase agreement with designated supplier and installer.
      4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
      5. Promptly inspect Products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
      6. Product handling at the site, including unloading, uncrating and storage, protection of Products from elements and from damage and labor for installation and finishing.
      7. The Contractor shall include in his Bid all fees for all cash allowances.

e. Funds will be drawn from Cash Allowances only by written authorization from Owner.
f. Cash Allowances – **Base Bid**:
   1. Contingency Allowance – In addition to the specification sections listed above, include an allowance of **$20,000.00** in the general bid and contract amount to be included in the contractors base bid. This allowance shall be used at the sole discretion of the Architect and/or Owner specifically for hidden conditions discovered in the field or on site, the addition of labor, parts and/or materials required for timely completion in conjunction with the general scope of work.

5. ENUMERATION OF DRAWINGS AND SPECIFICATIONS
   a. Correlation. Accompanying these Specifications are the Drawings, which jointly with these Specifications, are intended to explain each other and describe and coordinate the work to be performed under the Contract.
   b. Verification of Documents. Before submitting his bid, each Bidder shall check his set(s) of Drawings and Specifications and advise the Architect if any sheets are missing.
   c. Specifications Explanations. For convenience of reference, the Specifications are separated into Titled Divisions and Sections. Such separation shall not, however, operate to make the Architect an arbiter to establish limits between the Contractor and Subcontractor or Sub-Subcontractor.
   d. Drawings. Refer to LIST OF DRAWINGS.
   e. Specifications. Refer to TABLE OF CONTENTS.

6. WARRANTIES
   Before being eligible for final payment, Contractor shall deliver to Owner, through Architect, all special warranties specified for materials, equipment and installation.

7. OPERATING INSTRUCTIONS
   Before being eligible for final payment, Contractor shall deliver to Owner, through Architect, one (3) 3-ring binder copies and two (2) jump drives of manufacturer's operating instructions, one (1) complete set of shop drawings on each piece of equipment, and such framed instructions as instructed.

8. AS-BUILT DRAWINGS
   Before being eligible for final payment, the Electrical and Mechanical Contractors shall prepare and deliver to Owner, through Architect, one (1) set of AS-BUILT DRAWINGS. These drawings may consist of marked-up prints, if the Contractor so chooses, but shall show the correct location of every item of equipment, piping, conduit, panel boards, ductwork, switches, valves, etc. If marked-up prints are used, they shall be new prints.

9. CERTIFICATE OF COMPLIANCE
   Upon completion of project, Contractor is to furnish written Certification to the Architect that he has complied with every paragraph of the Specifications and Drawings.

10. CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS
    Upon completion of project, Contractor shall submit to Owner a signed Contractor's Affidavit of Release of Liens prior to final payment.

11. CONTRACTOR'S MONTHLY APPLICATION FOR PAYMENT FORM
    Contractor's monthly Application for Payment shall be submitted as per General Conditions. AIA Document G702, Application and Certificate for Payment is approved and acceptable.

12. FILING AND RECORDING OF BONDS
    In addition to furnishing the number of combination Performance Bond and Labor and Materials Payment Bond, and Statutory Bond, if required, the Contractor shall file copies of such bonds with Clerk of the District Court and furnish Architect with receipt furnished by Clerk of the District Court, covering charges for filing and recording of said bonds.

13. STATUTORY BONDS
    In addition to furnishing the combination Performance and Labor and Materials Payment Bond specified in General Conditions, the Contractor shall furnish Statutory Bond in an amount not less than 100% of the Agreement in such numbers and form stated in Sample Copy bound in the Specifications. Statutory Bond shall be filed and recorded with Clerk of the District Court, as specified in Paragraph - FILING AND RECORDING OF BONDS.

14. DOCUMENTS FURNISHED CONTRACTORS
    The General Contractor will be furnished, free of charge, the following working drawings and specifications, including modifications for construction of the project - 5 sets. The General Contractor will be responsible for distribution of these sets to the Subcontractors and suppliers. The Contractor shall pay the actual cost of reproduction and postage for all additional sets requested by him.

15. SALES TAX EXEMPTIONS

a. Materials and equipment incorporated into this project **are exempt** from the payment of sales tax under the laws of the State of Kansas and such **sales tax shall not be included in the Bid of the Bidder.**

b. The Owner will provide the Contractor with a proper exemption certificate within twenty (20) days of the Contract date.

1) Should the Owner fail to provide an exemption certificate within the required time period, the Contractor shall be reimbursed monthly for all sales tax amounts for which he becomes liable until such certificate is provided.

2) To minimize the Contractor's record keeping expense, the Owner shall provide an exemption certificate within sixty (60) days or it shall be presumed that the project will proceed on a non-exempt basis, and the Contract amount shall be equitably adjusted in writing in a lump sum amount sufficient to cover the Contractor's sales tax expense.

3) Upon issuance of a proper exemption certificate to the Contractor, the Contractor shall assume full responsibility for his own proper use of the certificate, and shall pay all costs of any legally assessed penalties relating to the Contractor's use of the exemption certificate.

END OF SECTION 01019

CONTRACTOR'S REQUEST FOR INFORMATION

TO:

REQUEST FOR INFORMATION NO. _____
REQUESTED BY: _____
RESPONSE REQUIRED BY: _____

RE:

SPECIFICATION REFERENCE: _____
DRAWING REFERENCE: _____

SUBJECT: DISCREPANCY: _____ CLARIFICATION: _____ OTHER: _____

REQUEST:

_____
_____
_____
_____
_____
_____
_____
_____
_____

SIGNED: _____ DATE: _____

ARCHITECT'S RESPONSE: This information is provided as an interpretation of the Contract Documents for implementation. It shall not be authorization for change to the Contract Sum or the Contract Completion Time. Should this information result in a claim for a change in the Contract Sum or Contract Completion Time, the Contractor shall notify the Architect within twenty (20) calendar days of receipt.

_____
_____
_____
_____
_____
_____
_____
_____
_____

Response Distribution
Original - Contractor

SIGNED: _____ DATE: _____

SUBSTITUTION REQUEST FORM

ONE ITEM PER FORM
FILL IN ALL BLANKS

Project: _____ Date: _____

We hereby submit for your review the following substitution for the following specified material for the above project:

Section	Page	Paragraph	Specified Material

PROPOSED SUBSTITUTION: _____

Attach complete technical data, including laboratory tests, if applicable. Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

A. Does the Substitution effect dimensions shown on Drawings in any way?

_____

B. Will the undersigned pay for any changes to the building design, including engineering and detailing costs caused by the requested substitution?

_____

C. What effect does substitution have on schedule or other trades?

_____

D. What effect does substitution have on cost?

_____

E. Differences between proposed substitution and specified items are:
_____ Same _____ Different (Explain)

_____

F. Contractor represents that he has investigated the proposed product and determined that it meets or exceeds the quality of the specified product.

SUBMITTED BY:

_____ Accepted _____ Accepted as Noted
_____ Not Accepted _____ Received Too Late

_____
(Firm)

_____ _____ _____
(Address) (By) (Date)

_____ _____
(Telephone) (Remarks)

_____ _____
(Signature)

FINAL LIEN WAIVER AND RELEASE

Reference that certain Agreement between _____, as Contractor, and _____ as Owner, dated _____, on the project known as _____ located at _____for work to be performed by said Contractor.

Reference also that certain invoice of Contractor to said Owner in the Amount of $_____ for work, labor and materials installed in or furnished for said project by and through _____.

The receipt by Contractor of Owner's remittance for the amount said invoice, contingent upon the final clearance and payment of said remittance, shall constitute payment for the full contract amount, including change orders and all other claims or demands of any nature whatsoever which Contractor has or may have in connection with the Project or Contract referenced herein, of $_____, for which Contractor (a) agrees to and does hereby waive and release said property, project and the Owner and all bond or payment sureties and guarantors from; and (b) does hereby agree to protect, indemnify, defend and hold harmless said property, project, Owner, sureties and guarantors against;

(1) any and all liens, statutory or otherwise, and

(2) any or all obligations under any bond or guaranty for payment furnished by or to said Owner, whether pursuant to agreement or requirement of law, and

(3) any and all other claims whatsoever, statutory or otherwise,

for any and all work, labor and materials furnished by or through said Contractor, its subcontractors and material suppliers for the entirety of said project.

The remittance of the Owner, identified as payment of said above invoice and endorsed by Contractor and marked "paid" or otherwise canceled by the bank against which said remittance was drawn shall constitute conclusive proof that said invoice was paid and the payment thereof was received by the Contractor, and thereupon, this final lien waiver shall become effective automatically and without requirement of any further act, acknowledgment or receipt of the part of said Contractor.

Contractor does further warrant that Contractor has not and will not assign its claims for payment nor its right to perfect a lien against said property and project, and the undersigned representative of the contractor has the right to execute this waiver and release thereof.

The undersigned representative of Contractor does hereby certify under oath that he is fully authorized and empowered to execute this instrument for and in behalf of said Contractor and to bind them hereto and does in fact so execute this final lien release.

Dated this _____ day of _____, 20____.

Contractor: _____

By: _____

Title: _____

Subscribed and affirmed to before me, the undersigned Notary Public within and for the State of _____ and the County of _____, this _____ day of_____, 20____, in the City of _____.

_____
Notary Public within and for said
County and State

SECTION 01030

ALTERNATES

A. GENERAL

a. The General Contractor shall state in his Bid Form the amount of dollars to be ADDED or DEDUCTED from his Base Bid for the following Alternates.

b. Alternates are not in order of acceptance.

c. It shall be the responsibility of the General Contractor to advise all necessary personnel and suppliers as to the nature and extent of all Alternates selected by the Owner.

1. ALTERNATE NO. 1

The Contractor shall state the amount of dollars to be added to the Base Bid for all work, labor and materials, associated with the installation of a New Stair from first floor to second as well as an Elevator Shaft. Include any demolition and new materials, equipment and finishes required to achieve proposed work.

Add $ _____

2. ALTERNATE NO. 2

The Contractor shall state the amount of dollars to be added to the Base Bid for all work, labor and materials, associated with the installation of Concrete Slab in West Basement Area. Work will involve removal of existing soil to where is 8" below adjacent east basement slab. Install 4" sand base, 15 mil vapor barrier and 4" concrete slab.

Add $_____

3. ALTERNATE NO. 3

The Contractor shall state the amount of dollars to be deducted from the Base Bid for all work, labor and materials, associated with NOT installing the False Ceiling Beams (except for center north-south beam) and Perimeter Soffits at Assembly #102, Hall #107, Kitchen #108 as well as all False Wall Columns. Ultimate result is a single monolithic suspended acoustical ceiling.

Deduct $_____

4. ALTERNATE NO. 4

The Contractor shall state the amount of dollars to be added to the Base Bid for all work, labor and materials, associated with Staining of Designated Exterior Brick area at the south side and s.e. side as indicated on Sheet A3.2.

Add $_____

5. ALTERNATE NO. 5

The Contractor shall state the amount of dollars to be deducted from the Base Bid for all work, labor and materials, associated with installation of the Fire Sprinkler System. Do NOT include material and work involved for the installation of the main service sprinkler line to the building.

Deduct $_____

6. ALTERNATE NO. 6

The Contractor shall state the amount of dollars to be deducted from the Base Bid for all work, labor and materials, associated with installation of the Main Service Sprinkler Line to the building. Do NOT include material and work involved for the installation of the fire sprinkler system.

Deduct $_____

7. ALTERNATE NO. 7

The Contractor shall state the amount of dollars to be deducted from the Base Bid for all work, labor and materials, associated with the installation of the Fire Alarm System.

Deduct $_____

8. ALTERNATE NO. 8

The Contractor shall state the amount of dollars to be deducted from the Base Bid for all work, labor and materials, associated with installation of the Interior Wainscot at Assembly #102, Hall #107 and Kitchen #108. PVC chair rail and base of similar profile indicated shall remain and shall NOT be included in this price.

Deduct $_____

9. ALTERNATE NO. 9
The Contractor shall state the amount of dollars to be deducted from the Base Bid for all work, labor and materials, associated with installation of all Ceramic Wall Tile in Restrooms #104 and #105. Include installation of 40-mil Wall Protection (48" wainscot) at all walls with paint above instead. Include associated matching wall protection trim.

Deduct $_____

10. ALTERNATE NO. 10
The Contractor shall state the amount of dollars to be deducted from the Base Bid for all work, labor and materials, associated with installation of Epoxy Resin Floor System (and self-cove base) at Restrooms #104 and #105. Include installation of LVT and rubber base.

Deduct $_____

11. ALTERNATE NO. 11
The Contractor shall state the amount of dollars to be deducted from the Base Bid for changing Prefinished Panelized Solid Door Wood Doors to be Prefinished Slab Solid Core Wood Doors.

Deduct $_____

12. ALTERNATE NO. 12
The Contractor shall state the amount of dollars to be deducted from the Base Bid for all work, labor and materials, associated with providing Single Phase Main Service in lieu of 3-Phase. Adjust all associated equipment to meet single phase requirements.

Deduct $_____

13. ALTERNATE NO. 13
(If added by Addendum)

Add / Deduct $_____

14. ALTERNATE NO. 14
(If added by Addendum)

Add / Deduct $_____

END OF SECTION 01030

SECTION 01310
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Interpretation (RFIs).
B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3 DEFINITIONS
A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION
A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with 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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
C. 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.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.
E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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 telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: 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 (**By Architect**): Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than **15** days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for RFIs.
      g. Procedures for and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. LEED requirements.
      l. Preparation of Record Documents.
      m. Use of the premises and existing building.
      n. Work restrictions.
      o. Owner's occupancy requirements.
      p. Responsibility for temporary facilities and controls.

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

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
a. The Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings (**By Architect**): Conduct progress meetings at **monthly** intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review 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) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) RFIs.
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Minutes: Contractor shall record the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
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.

E. Coordination Meetings: Conduct Project coordination meetings at **weekly** intervals. Project 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 each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined 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.
b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each contractor present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.

3. Reporting: Contractor shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
   1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
   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 interpretation and the following:
   1. Project name.
   2. Date.
   3. Name of Contractor.
   4. Name of Architect.
   5. RFI number, numbered sequentially.
   6. Specification Section number and title and related paragraphs, as appropriate.
   7. Drawing number and detail references, as appropriate.
   8. Field dimensions and conditions, as appropriate.
   9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   10. Contractor's signature.
   11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
      a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow **seven** working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
   1. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
   2. 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 Division 1 Section "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 **7** days of receipt of the RFI response.

D. 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.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were dropped and not submitted.
   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.
   9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. 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. 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.

B. Submittals Schedule: Comply with requirements in Division 1 for list of submittals and time requirements for scheduled performance of related construction activities.

C. Processing Time: Allow enough 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 15 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately on label or beside title block to record Contractor's review and approval markings and action taken by Architect
3. Include the following information on label for processing and recording action taken:
    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.
    i. Number and title of appropriate Specification Section.

j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

E. Deviations: Highlight or otherwise specifically identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals**,** without review**,** received from sources other than Contractor.
1. Transmittal Form: Use General Contractor's standard transmittal form
2. Transmittal Form: Provide locations on form for the following information:
a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Transmittal number**,** numbered consecutively.
k. Submittal and transmittal distribution record.
l. Remarks.
m. Signature of transmitter.
3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

H. 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 Architect's and/or Consultant/s stamp indicating approval action.

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 review and approval by Architect and/or Consultant.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. 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 printed data are not suitable 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.
3. Include the following information, as applicable:
a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.

j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: **Submit one (1) electronic copy of Product Data, unless otherwise indicated.**

C. 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.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   f. Shopwork manufacturing instructions.
   g. Templates and patterns.
   h. Schedules.
   i. Design calculations.
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.
   m. Relationship to adjoining construction clearly indicated.
   n. Seal and signature of professional engineer if specified.
   o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
2. Sheet Size (**For O&M Manuals Only**): Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
3. Number of Copies: **Submit one (1) electronic copy of each submittal.** Submit additional printed copies where copies are required for operation and maintenance manuals.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
3. 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.
4. 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 two 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.
5. 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 two sets of Samples. Architect will retain one Sample set.
   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.

E. Product Schedule or List: 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.
   2. Number and name of room or space.
   3. Location within room or space.
   4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 1.

G. Submittals Schedule: Comply with requirements specified in Division 1.

H. Application for Payment: Comply with requirements specified in Division 1.

I. Schedule of Values: Comply with requirements specified in Division 1.

J. 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
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.
   4. Number of Copies: Submit two copies of subcontractor list, unless otherwise indicated.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
   1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
   2. Certificates and Certifications: Provide a notarized 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.
   3. Test and Inspection Reports: Comply with requirements specified in Division 1

B. Coordination Drawings: Comply with requirements specified in Division 1.

C. Contractor's Construction Schedule: Comply with requirements specified in Division 1.

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare 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.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

J. Material Test Reports: Prepare 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.

K. Product Test Reports: Prepare written reports indicating 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.

L. Research/Evaluation Reports: Prepare 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:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 1.

N. Preconstruction Test Reports: Prepare 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.

O. Compatibility Test Reports: Prepare 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.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1.

R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
   1. Preparation of substrates.
   2. Required substrate tolerances.
   3. Sequence of installation or erection.
   4. Required installation tolerances.
   5. Required adjustments.
   6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
   1. Name, address, and telephone number of factory-authorized service 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.

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

V. Construction Photographs and Videotapes: Comply with requirements specified in Division 1.

W. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

2.3 DELEGATED DESIGN

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.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of 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.
   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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. 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. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. Informational Submittals: Architect will review each submittal and will not return it. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

END OF SECTION 01330

SECTION 01500

TEMPORARY FACILITIES

1. GENERAL
Should conflict occur between the Temporary Facilities and the General Conditions, the requirements of this Section take precedence.

2. TEMPORARY HEAT
A. The General Contractor shall provide heat, fuel and services as necessary to protect all work and materials against injury from dampness and cold until final acceptance of all work and material in the Contract, unless the building or buildings are fully occupied by the Owner prior to such acceptance, in which case, the Owner shall assume all expenses of heating from date of occupancy. The General Contractor shall provide heat as follows:
   1) At all times during the placing, setting and curing of concrete, provide sufficient heat to insure the heating of the spaces involved to not less than 50° F.
   2) From the beginning of the application of gypsum board taping and during the setting and curing period, provide sufficient heat to produce a temperature in the spaces involved of not less than 50° F.
   3) For a period of ten (10) days previous to the placing of interior wood finish and throughout the placing of this and other interior finishing, varnishing, painting, etc., and until final acceptance of the work or until full occupancy by the Owner, provide sufficient heat to produce a temperature of not less than 70° F. Heating Subcontractor shall set such necessary temporary radiation as may be required.
   4) Mechanical Subcontractor is responsible to provide temporary heating.
   5) Permanent HVAC System: If Owner authorizes use of permanent HVAC system(s) prior to substantial completion; provide filters at air grilles in system. Before Substantial Completion, all units and ductwork shall be thoroughly cleaned and restored to original or new condition. Manufacturer's warranties on new equipment will not begin until substantial completion and cleaning of units and duct work has been performed.

3. TEMPORARY FIELD OFFICES (CONTRACTORS OPTION)
A. General Contractor shall provide and maintain in good condition, a painted weatherproof field office (adequate size trailer acceptable) for use of General Contractor. Building to remain property of General Contractor. Possible location is the west side of Green Street adjacent to the Community Hall.
B. Electrical and Mechanical Subcontractors shall maintain similar field office as needed, meeting requirements of previous paragraph.

4. TEMPORARY ENCLOSURES
General Contractor to provide:
A. Temporary weathertight enclosures for all exterior openings as soon as possible as walls and roofs are built to protect work from weather. Temporary exterior doors equipped with padlocks.
B. In cold weather, provide additional precautions necessary, including heat at such openings to protect building and contents.

5. TEMPORARY STORAGE
A. The Contractor shall provide and maintain on the premises watertight storage enclosures for storage of all materials which may be damaged by weather. These enclosures shall have floors raised above the ground. Possible location is the west side of Green Street adjacent to the Community Hall.

6. TEMPORARY CONSTRUCTION ITEMS
A. General Contractor shall furnish necessary temporary stairs, chutes, runways, scaffolds, ladders, and hoist.

7. TEMPORARY TOILET ACCOMMODATIONS
A. The General Contractor shall provide for the use of all workmen, in accordance with local ordinances, ample temporary sanitary toilet accommodations and keep such clean and free from flies. Prior to completion of the Contract, all connections and appliances connected with same will be removed and the premises left perfectly clean. Location shall be the north side of the Community Hall.

8. TEMPORARY TELEPHONE
A. The General Contractor shall install at his own expense, a job telephone, and shall pay for all local calls. All long distance calls shall be paid by party making the call.

9. TEMPORARY LIGHT, POWER, AND GAS
   A. General Contractor shall arrange for all permanent and temporary service, pay for all expenses therewith and bring services to building and run extensions to locations necessary for operations.
   B. Permit other Subcontractors to use same. Other Subcontractors requiring additional extensions, make and remove same at their expense.
   C. Owner shall pay for all electricity and gas consumed.

10. WATER FOR CONSTRUCTION
   A. The Contractor shall be responsible to provide water for construction until the permanent water service is installed. Owner will pay for all water consumed.

11. TRASH DUMPSTER
   A. Contractor shall provide a dumpster for construction debris. Location shall be the north side of the Community Hall. Locating at south side is allowed, but shall be limited.

END OF SECTION 01500

SECTION 01700

PROJECT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Related Documents
B. Summary
C. Completion of a Building and/or Phase
D. Final Completion and Final Payment
E. Record Document Submittals
F. Starting Systems
G. Operating and Maintenance Instructions
H. Final Cleaning

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division - 1 Specification sections, apply to this section.

1.03 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operating and maintenance manual submittal.
   4. Submittal of warranties.
   5. Final cleaning.
   6. Record vellum drawings.

B. Closeout requirements for specific construction activities are include in the appropriate Sections in Divisions 2 through 33.

1.04 SUBSTANTIAL COMPLETION

A. Substantial completion
   1. The Contractor and each Subcontractor shall carefully and regularly check their work for conformance with the Contract Documents as the work is being done. Unsatisfactory work shall be corrected as the work progresses and not be permitted to remain and become a part of the Punch List.
   2. The Contractor shall conduct a pre-punch list inspection. The written pre-punch list shall be distributed to affected subcontractors, Architect and Owner's Representative. The Contractor shall advise the Architect in writing upon completion of the pre-punch list. This notification shall so serve to notify the Architect that the Work is ready for the punch list inspection.
   3. The Architect shall make arrangements for his Punch List Inspection at the earliest possible date following Contractor notification of completion of the pre-punch list. Transmittal of the Punch List to the Contractor shall set the date for a Reinspection prior to issuance of a Certificate of Substantial Completion. Upon receipt of the Punch List, the Contractor shall within seven (7) days bring to the attention of the Architect in writing any questions that he or any of his Subcontractors may have concerning the requirements of the Punch List.
   4. When advised by the Contractor that the Punch List items have been completed, the Architect shall conduct a Reinspection with the Contractor, any needed Subcontractors (and the Owner's Representative where applicable) to determine whether the Certificate of Substantial Completion can be issued. A Certificate of Substantial Completion will only be issued after Codes Administration authority’s document final approval of the building or phase.

      If the first reinspection requested by the contractor and performed by the architect/engineer determines that punch list items remain incomplete, and the outstanding items have not been previously questioned by the contractor as required in Paragraph 3 above, then, all subsequent reinspections by the architect will be paid for by the Contractor.
   5. When issued, the Certificate of Substantial Completion shall name the date, triggering the beginning of the warranty period (with any items to have a later starting date specifically noted). The Certificate shall also have attached to it the uncompleted Punch List items, and shall name the date for their Final Completion. The Certificate of Substantial Completion shall also state the responsibilities of the Owner and the Contractor for maintenance, heat, utilities, insurance, and building security.

6. Acknowledgment of the Date of Substantial Completion by the signature of all parties on the Certificate implies possession of the premises by the Owner, and completion of incomplete Punch List items by the Contractor and the Subcontractors, at the Owner's convenience. The Owner shall cooperate in permitting the Contractor access to the work for the completion of Punch List items.
7. A Certificate of Substantial Completion for the Work, or portion of Work, as applicable, will only be issued after the requirements for the demonstration and instruction of operation and maintenance procedures as defined elsewhere by the Contract Documents, to the Owner's personnel have been satisfied by the Contractor.

B. Final Completion
1. Submit executed warranties, workmanship bonds, maintenance agreements, inspection certificates and similar required documentation for specific units of work, enabling Owner's unrestricted occupancy and use.
2. Submit maintenance manuals **(two electronic copies on jump drives and one 3-ring binder)**, tools, keys, spare parts, and extra stock materials.
3. Complete instruction of Owner's operating personnel with start-up of all systems.
4. Complete final cleaning and remove temporary facilities.
(Final cleaning - at closeout time of each building, clean, reclean entire work to normal level for "first class" maintenance/cleaning of building projects of a similar nature. Remove non-permanent protection and labels, polish glass, clean exposed finishes, touch-up minor finish damage, clean or replace filters of mechanical systems, remove debris and broom clean non-occupied spaces, sanitize plumbing/food service facilities, clean light fixtures and replace burned-out/dimmed lamps, sweep and wash paved areas, police yards and grounds, and perform similar cleanup operations needed to produce a "clean" condition as judged by Architect/Engineer.)
5. All punch list work must be completed, reviewed, and accepted by the Architect/Engineer.

1.05 FINAL COMPLETION AND FINAL PAYMENT

A. Provide submittals to Architect that are required by governing or other authorities. Confirm that all submittals required by the construction documents have been transmitted.

B. Final Completion: For the purpose of determining a date at which the project is finished, Final Completion may be defined to include, but is not limited to:
1. Substantial Completion.
2. Submission and acceptance by the Architect of Project Record Drawings.
3. Operation and Maintenance Data (including all air and water balance reports). **Two electronic copies on jump drives and one 3-ring binder.**
4. All applicable Owner training sessions with meeting notes distributed (video tapes, if applicable).
5. Final cleaning.
6. Adjusting (hardware, HVAC, etc.).
7 Warranties submitted by General Contractor and accepted by Architect.
8. Spare parts and maintenance materials turned over to proper District personnel.
9. All punch list work completed, reviewed, and accepted by the Architect.

All of the above items are as required by individual specification requirements as found in the Contract Documents. These individual requirements shall take precedence over this definition if any conflict should arise.

C. Upon written notice by the Contractor that the Reinspection Punch List items are completed, the Architect shall verify this by inspection and shall issue to the Owner a final Certificate of Payment stating that, to the best of their knowledge, information and belief, the Work has been completed in accordance with the terms and conditions of the Contract Documents, and that the entire balance found to be due the Contractor, and noted in said final Certificate of Payment, is due and payable. The Owner shall endeavor to make payments within thirty (30) days.

1.06 RECORD DOCUMENT SUBMITTAL

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: A set of blue- or black-line drawings of the original bidding documents will be provided by the Owner to the Contractor for the following use:
1. If the Contractor elects to vary the work from the Contract Documents, and secures prior approval from the Architect, he shall record in a neat, readable manner, all such variances on the blue-or black-line drawings furnished.

2. For plumbing; heating; ventilating, and air-conditioning; electrical and fire protection work, Record Document Drawings shall be maintained by the Contractor as the work progresses and as follows:
    a. All deviations from the sizes, locations, and from all other features of all installations showing the Contract Documents shall be recorded.
    b. In addition, it shall be possible, using these Drawings, to correctly and easily locate, identify and establish sizes of piping, direction, etc., as well as all other features of work which will be concealed.
        1) Locations of underground work shall be established by dimensions to column lines or walls, by locating all turns, etc., and by properly referenced centerline or invert elevations and rates of fall.
        2) For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. In some cases, this may be by dimension, in others, it may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actually installed. Architect's decision in this matter shall be final.
3. Blue- or Black-Line Record Document Drawings shall be kept up-to-date during the entire course of the work and shall be available upon request for examination by the Architect, and, when necessary, to establish clearances for other parts of the Work.
4. The following requirements apply to all Record Document Drawings:
    a. They shall be maintained at the Contractor's expense.
    b. All such Drawings shall be done carefully and neatly by a competent draftsperson and in an approved form.
    c. Additional drawings shall be provided as necessary for clarification.
    d. The Record Document Drawings (both blue- or black-line and reproducible) shall be returned to the Architect upon completion of the work and are subject to the approval of the Architect.
    e. Delete Architect title block and seal from Record Document Drawings.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.
1. Legibly mark and record at each Product section description of actual Products installed, including the following:
    a. Manufacturer’s product name and product model number.
    b. Product substitutions or alternates utilized.
    c. Changes made by Addenda and Modifications.
2. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
3. Record Project Manual shall be maintained at the Contractor's expense.
4. Record Project Manual shall be maintained in a neat, readable manner. Contract work variations shall be recorded in the correct corresponding Technical Section of the Project Manual.
5. Delete Architect seal from Record Project Manual.

D. Record Shop Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Shop Drawings as finally approved. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark drawings accurately; record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner, but was not shown on Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record shop drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.

E. Record Product Data: maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
1. Upon completion of mark-ups, submit complete set of record Product Data to the Architect for the Owner's records.

F. Record Documents and Shop Drawings: Contractor to supply one complete set of approved shop drawings. Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to fine (main) floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenance, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenance concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract Drawings.

G. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work or to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

H. Miscellaneous Record Submittal: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittal in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

I. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Submit three sets prior to final inspection. Bind properly indexed data in individual heavy-duty 3-inch, 3-ring vinyl-covered binders, 8-1/2 x 11 inch text page format, with pocket folders for folded sheet information. Also provide one (1) cd.
   1. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
   2. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
   3. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified.
   4. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers where they can be reached for emergency service at all times, including nights, weekends, and holidays.
   5. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
      g. Emergency instructions.
      h. Spare parts list.
      i. Wiring diagrams.
      j. Recommended "turn around" cycles.
      k. Inspection procedures.
   6. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties and bonds.
   7. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Architect comments. Revise content of documents as required prior to final submittal.
   8. Submit final volumes revised, within ten days after final inspection.

J. Record reproducible vellum drawings. Contractor shall submit 1 copy of all record contract drawings to the Owner in the form of reproducible vellum sheets.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 STARTING SYSTEMS

A. Coordinate schedule of start-up of various equipment and systems.

B. Notify Architect, Owner, and Program Manager seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible manufacturer's representative (Contractors' personnel) in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.

3.02 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacture's representatives. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.03 FINAL CLEANING

A. General: General cleaning during construction is required by the General Provisions and Covenants and included in Division 1 Section "Temporary Facilities".

B. Cleaning: **Employ professional cleaners** for final cleaning so that the facility is **"move-in ready".** Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
   a. Remove labels that are not permanent labels.
   b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
   c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
   d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or place excess materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01700

SECTION 01731

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.3 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. 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.
   1. Primary operational systems and equipment.
   2. Air or smoke barriers.
   3. Fire-suppression systems.
   4. Mechanical systems piping and ducts.
   5. Control systems.
   6. Communication systems.
   7. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related 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.
   1. Water, moisture, or vapor barriers.
   2. Membranes and flashings.
   3. Exterior curtain-wall construction.
   4. Equipment supports.
   5. Piping, ductwork, vessels, and equipment.
   6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. 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.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. 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 prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut 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. 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 as small as possible, neatly to 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 and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      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, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang 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.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01731

SECTION 01732
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY
- A. This Section includes the following:
  1. Demolition and removal of building or structure.
  2. Demolition and removal of selected site elements.

1.2 QUALITY ASSURANCE
- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- **C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.**
- D. Standards: Comply with ANSI A10.6 and NFPA 241.

1.3 PROJECT CONDITIONS
- A. Conduct demolition so adjacent property owner's operations will not be disrupted.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- **C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the work.**
  1. If additional materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. 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 (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION
- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- 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. Engage a professional engineer to survey 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 demolition operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  1. Arrange to shut off indicated utilities with utility companies.
  2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
    a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

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.

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.
    2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
    3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
    4. Cover and protect furniture, furnishings, and equipment that have not been removed.
    5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."

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. 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, to minimize disturbance of adjacent surfaces. 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 fire watch and portable fire-suppression devices during flame-cutting operations.
    5. Maintain adequate ventilation when using cutting torches.
    6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
    7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
    8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
    9. Dispose of demolished items and materials promptly.

B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Reinstalled Items:
    1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
    2. Protect items from damage during transport and storage.

3. 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.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

F. Roofing: Remove no more existing roofing than 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.

G. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

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.
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.

C. 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 01732

SECTION 02110

SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Removal of existing paving, curbs, sidewalks, landscaping and improvements.
- B. Topsoil excavation.

1.02 REGULATORY REQUIREMENTS
- A. Conform to applicable local codes and ordinances for disposal of debris, burning debris on site, use of herbicides, etc.
- B. Coordinate clearing Work with utility companies as required.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 PREPARATION
- A. Verify that existing plant life designated to remain, is tagged, or identified.

3.02 PROTECTION
- A. Locate, identify, and protect utilities that remain, from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping.
- C. Protect bench marks and existing structures from damage or displacement.

3.03 CLEARING
- A. Clear areas required for access to site and execution of Work.
- B. Remove paving, curbs, and improvements designated.
- C. Remove trees and shrubs indicated. Remove stumps, root system, surface rock, and other areas indicated or implied for completion of the project.
- D. Strip and clear vegetation from areas designated to be filled, excavated, regraded, or landscaped.

3.04 REMOVAL
- A. Remove debris, rock, and extracted plant life from site.

3.05 TOPSOIL EXCAVATION
- A. Excavate clean topsoil from areas to be further excavated, filled, re-landscaped, or regraded.
- B. Stockpile in area designated on site to depth not exceeding 8 feet. Protect from erosion. Remove excess topsoil not being reused, from site.

END OF SECTION 02110

SECTION 02205

SOIL MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Subsoil and topsoil materials.

1.02 REFERENCES
- A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ASTM D2487 - Classification of Soils for Engineering Purposes.

PART 2 PRODUCTS

2.01 SOIL MATERIALS
- A. Fill Material: Under slabs and within the zone of influence of foundation elements must be a material approved by a geotechnical engineer hired by the General Contractor.
- B. Fill and Backfill Material: Other areas, foundation backfill, site grading, and pavement, should be clean site material or similar borrow material, approved by a geotechnical Engineer. Foreign matter shall be limited in size to 1 ½" in greatest dimension, and be limited to no more than 5% by volume or weight.
- C. Topsoil: Incorporate topsoil into subsoil 3"- 4". Topsoil should be blended and contain the following components by percentage:

Organic Matter:	4 - 6 %
Sand (ASTM - 300 and 75% between .25mm and .75mm):	40 - 50%
Silt:	20 - 25%
Clay:	25 - 40%

2.02 SOURCE QUALITY CONTROL
- A. Inspection and testing will be performed by an independent laboratory, Owner shall bear all related costs under provisions of General Requirements.
- B. Tests and analysis of soil material will be performed in accordance with ANSI/ASTM D698.
- C. If tests indicate materials do not meet specified requirements, change material and retest at no cost to Owner.

PART 3 EXECUTION

3.01 STOCKPILING
- A. Stockpile materials on site at locations indicated or in areas that will not impact project completion.
- B. Stockpile in sufficient quantities to meet project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.02 STOCKPILE CLEANUP
- A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 02205

SECTION 02220

EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES

1.01 SCOPE OF WORK

A. This work shall include the furnishing of all labor, materials, and equipment necessary for the clearance, excavating, trenching and backfilling, the continual drainage of excavation, sheeting, bracing and shoring of sides of excavation, backfilling around structures and over pipe lines, the disposal of excess excavated materials, unsuitable materials and finish site grading of the areas disturbed by the trenching operations.

1.02 CLASSIFICATION OF EXCAVATED MATERIALS:

A. Excavated materials shall be unclassified and shall include any and all materials including water and rock encountered during the construction of the work.

1.03 BLASTING:

A. No blasting shall be permitted on this project.

1.04 TRENCH EXCAVATION:

A. The trench shall be dug to the required alignment and depth as shown on the Plans or directed by the Engineer and only so far in advance of pipe laying as the Engineer shall permit. Minimum cover on all pressure pipe shall be 42-inches, unless otherwise specified. Trench width shall be a minimum of 12-inches greater than the outside diameter of the barrel of the pipe and a maximum of 24-inches greater than the outside diameter of the barrel of the pipe. The trench shall be braced and drained when necessary to ensure safe working conditions at all times. Where water is encountered, the bracing or sheeting shall be designed and placed to drain water to a sump outside the sheeting area. No water will be permitted in the trench. Bracing and/or sheeting will be left in place until the line pipe is installed and sufficient backfill is in place so as no damage to the line pipe may result from its removal. All trenching shall provide a uniform grade which will provide full support for the entire length of pipe. Over-depth excavation and non-uniform grades shall be backfilled with suitable material and compacted to provide uniform, continuous support for the entire length of pipe.

B. Rock Excavation: Where rock is encountered, it shall be removed to a depth of at least 6-inches below grade. The amount of over-excavated material shall be replaced with either fine sand or earth which is free of stones. This backfill shall be placed and compacted by hand or a mechanical method approved by the Engineer prior to installation of line pipe.

1.05 UNAUTHORIZED TRENCH WIDTHS:

A. Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing tables the size of pipe and depth of cover at such point, either pipe of adequate design, total concrete pipe encasement, or arch concrete encasement as required by loading conditions and as determined by the Engineer shall be furnished and installed by and at the expense of the Contractor. The determination of necessary pipe, special embedment, or arch concrete encasement shall be based on a pipe strength equal to the minimum three edge bearing ultimate strength for rigid pipe, and prism loading for flexible pipe ultimate strength stipulated in the governing pipe specifications for the size and kind of pipe involved with a safety factor of 2. Trench loadings will be based on saturated backfill weighing 120 pounds per cubic foot with suitable allowance for truck or other live loads where required.

1.06 MECHANICAL EXCAVATION:

A. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground; in all such locations, hand excavating tools, and methods shall be used.

B. Mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be so operated that the control of the rough trench excavation bottom elevation is accurate and positive at all times, that uniform trench widths and vertical side walls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench and that the trench alignment is such that the pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and side walls of the trench as excavated at all points. Undercutting of the sidewall to obtain such clearance will not be permitted.

C. All mechanical trenching equipment, its operating condition and the manner of its operations, shall be subject at all times to the approval of the Engineer.

1.07 DEWATERING OF TRENCHES:

A. Pipe trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe encasement operations. Where the trench bottom is mucky or otherwise unstable because of the presence of ground water, and in all cases where the static ground water elevation is above the bottom of any trench or bell hole excavation, the ground water shall be lowered by means of well points and pumps, or by other means acceptable to the Engineer, to the extent necessary to keep the trench free from water and the trench bottom stable at all times when work within the trench is in progress. The disposal of water from trench dewatering operations shall be subject to the approval of the Engineer at all times; such waste water shall be conducted to existing drainage ditches, channels, or drains. Surface water shall be diverted to prevent it from entering trenches.

1.08 EARTH EXCAVATION BELOW PIPE SUBGRADE:

A. Pipe trenches shall be excavated below pipe subgrade elevations, as shown on the Plans to provide for the installation of granular pipe embedment material as specified hereinafter.

1.09 PIPE CLEARANCE IN ROCK:

A. Where rock is encountered in excavating and where it is necessary to place pipe in rock excavation, the rock shall be removed to provide a minimum clearance, for the size of the pipe being laid as set forth in the following table:

	Minimum Clearance	
Size of Pipe	Below Pipe	At Side of Pipe
12" AND SMALLER	6"	3"
15", 18" AND 21"	6"	4"

B. The clearance figures given in the above table are minimum clearances from the closest projection of the rock to the outside edge of the pipe, and are not average figures. All material removed from the trench in order to provide the above-specified clearance shall be replaced below and at the sides of the pipe with granular material as specified hereinafter. All replacement materials specified shall be furnished and installed by and at the expense of the Contractor.

1.10 TRENCH BOTTOM STABILIZATION:

A. Trench bottoms which become soft, mucky, or otherwise unstable during construction operations shall be stabilized, by and at the expense of the Contractor, with one or more layers of crushed rock or other suitable material, where and as necessary to provide a firm and stable base for granular pipe embedment material. Not more than 1/2-inch depth of mud or muck shall be allowed to remain on the stabilized trench bottom when the granular fill pipe foundation material is installed.

1.11 ARTIFICIAL FOUNDATIONS IN TRENCHES:

A. Whenever so ordered by the Engineer, the Contractor shall excavate to such depth below grade as the Engineer may direct and the trench bottom shall be brought to grade with such material as the Engineer may order installed. All timber, concrete foundations, wooden inverts, pipes, posts, stringers, and/or saddles, made necessary by quicksand or other treacherous soil, shall be installed as directed by the Engineer. Compensation for extra excavation, timber, concrete, or other foundations, except where provided by contract unit prices, shall be made in accordance with the contract provisions for "Extra Work".

1.12 TRENCH BRACING AND SHEETING:

A. Except where trench banks are cut on a stable slope to prevent caving or sliding, trenches shall be properly and substantially braced, and sheeted if and where necessary, to prevent caving or sliding and to provide adequate protection to workmen and to the pipe line during and after the construction thereof. Sheeting shall not be pulled unless the pipe strength is sufficient to carry trench loads based on the trench width to the back of the sheeting. Also, it shall not be pulled after backfilling. When ordered by the Engineer, wood sheeting shall be left permanently in the trench. Where sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported by stakes driven into the trench bottom on each side of the pipe and with the tops of the stakes supported by cross braces above the top of the pipe or by other means, approved by the Engineer, which will not result in the application of concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe for the purpose of supporting sheeting in the bottom of the trench may be removed after the specified pipe embedment has been completed beyond the point of cross brace removal.

1.13 BELL HOLES:

A. Excavation for bell holes for the various types of joints to be made, excavation for assembling and bolting mechanical joints or couplings, excavation in trench banks to provide additional working space, and any other excavation outside of rough excavation limits which may be required for pipe jointing operations shall be performed prior to the installation of the specified granular fill below pipe subgrade elevations to prevent contamination of the granular fill pipe foundation material.

B. Bell holes for mechanical joints in pipe shall provide adequate clearance for the tools and methods used in installing and bolting the joints.

C. Bell holes for boltless gasketed joint pipe shall be excavated to provide at least one-inch clearance between the pipe bell and the bottom of the bell hole.

D. Regardless of the type of joint, all excavations therefore shall be of sufficient size and depth that the joints can be properly made and so that no part of the pipe bell, if any, will be in contact with the trench bottom of granular fill thereon.

1.14 TRENCH BACKFILL:

A. The kinds of backfill materials to be used and the methods of placing and compaction therefore shall conform to the requirements shown on the Plans. Inundated backfill shall not be permitted without special consideration and approval of the Engineer.

B. Select Fill: Select material excavated from the existing trench, or imported, shall be used for pipe embedment and/or replacement of rock. The material shall be free from rock, debris and vegetation and uniform in size not exceeding 1-inch clods. The material shall have proper moisture to promote optimum compaction.

1. All select fill material beneath the pipe shall be compacted no more than necessary, in order to insure a slightly yielding support for the pipe placed thereon. Such material shall be loosely poured or scattered into the trench, to a maximum depth of 12 inches at any point, before spreading or leveling. When deposited in the trench, select fill material beneath the pipe shall be spread and graded to provide a uniform and continuous support for the installed pipe at all points between bell holes or pipe joints, except that it will be permissible to disturb or otherwise damage the finished subgrade surface by the withdrawal of pipe slings or other lifting tackle. No blocking of the pipe to achieve proper grade will be allowed.

2. All select fill material above the bottom of the pipe shall be placed in, not to exceed 6-inch layers, and compacted by adequate tamping, vibration, slicing with a shovel, rodding or by a combination thereof. All backfill compaction equipment, and the results obtained thereby, shall be subject at all times to the approval of the Engineer.

C. Granular Fill: Granular material for pipe embedment or replacement of rock or unsuitable foundation material removed from trench bottoms shall consist of crushed stone or pea gravel and shall be free from clay, and other materials which would cause the materials to crack or cake.

1. All granular fill material beneath the pipe shall be compacted no more than necessary, in order to insure a slightly yielding support for the pipe placed thereon. Such material shall be loosely poured or scattered into the trench, to a maximum depth of 12 inches at any point, before spreading or leveling. When deposited in the trench, granular fill material beneath the pipe shall be spread and graded to provide a uniform and continuous support for the installed pipe at all points between bell holes or pipe joints, except that it will be permissible to disturb or otherwise damage the finished subgrade surface by the withdrawal of pipe slings or other lifting tackle. No blocking of the pipe to achieve proper grade will be allowed.
2. All granular fill material above the bottom of the pipe shall be placed in not to exceed 6 inch layers and compacted by adequate tamping, vibration, slicing with a shovel, rodding, or by a combination thereof. All backfill compaction equipment, and the results obtained thereby, shall be subject at all times to the approval of the Engineer.
   a. Granular Fill - Pea Gravel: Natural stone; free of shale, clay, organic matter; graded in accordance with ANSI/ASTM C 136 within the following limits:

Sieve Size	Percent Retained
3/4-inch	0
1/2-inch	0 to 10
3/8-inch	30 to 60
No. 4	85 to 100
No. 8	95 to 100

D. Flowable Fill: Flowable fill for pipe shall be used when required by the Plans and also where conditions are such as to dictate the use thereof as determined by the Engineer. The flowable fill mix shall comply with the following criteria.

1. FLOWABLE FILL CRITERIA:
   a. Cement: ASTM C150, Type 1 Normal Portland, 0.60 percent or less alkalis where aggregates are alkali reactive. (100 lbs./cu.yd.)
   b. Fine Aggregate: Fine, natural sand consisting of mineral aggregate particles. (2,600 lbs./cu.yd.)
   c. Fly Ash: Class C, ASTM C618 (300 lbs./cu.yd.)
   d. Water: Clean and not detrimental to concrete. (70 gallons/cu.yd.)
   e. Compressive Strength: 50-100 psi at 28 days.

E. Pipe Embedment:

a. All pipe embedment material including bedding material below the bottom of the pipe shall be placed as shown on the Plans. Pipe embedment material shall extend upward to an elevation not less than 1/8 of the total trench backfill cover depth over the pipe or a minimum distance of 12 inches above the top of the pipe, whichever is greater, as shown on the Plans. Classes of pipe embedment to be used shall be as hereinafter specified.

b. Class A: Arch Encasement for pipe shall be used where required by the Plans and also where conditions are such as to dictate the use thereof as determined by the Engineer.

c. Class B: Bedding shall be used for all polyvinyl chloride pipe.

d. Class C: Bedding shall be used for all ductile iron pipe and concrete pipe.

F. Schedule:

1. Piping:
   a. Bedding Fill: Granular fill bedding material, 4 inches below pipe invert to 12 inches above top of pipe, compacted to no less than 95% of maximum dry density at optimum moisture content.
   b. Cover with subsoil fill, in 6-inch lifts, compacted to no less than 95% of maximum dry density at optimum moisture content.

c. Topsoil: 6 inches.

2. Pipe Under Paved Areas and Unpaved Roadways:
   a. Bedding Fill: Granular fill bedding material, compacted to no less than 95% of maximum dry density at optimum moisture content.
   b. Fill to Subgrade: Cover with subsoil fill, in 6-inch lifts, compacted to no less than 95% of maximum dry density at optimum moisture content.
   c. Pipe Under Slab-on Grade or Structural Slab: Flowable fill material shall be placed in lieu of pipeline bedding materials for at least 5 feet beyond the structure perimeter.
3. If compacted backfill is required for the full depth of trench above the required granular fill, tamped bedding, or arch concrete encasement material, then tamped backfill shall be used in all cases unless permitted otherwise by the Engineer.
4. After each pipe has been graded, aligned and placed in final position on the bedding material and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to firmly hold and maintain the pipe in proper position and alignment during subsequent pipe jointing, embedment and backfilling operations.
5. Pipe embedment material, in each case, shall be deposited in the trench in such a manner that it is scattered along the sides of the pipe and not dropped in compacted masses. In addition, such material shall be deposited and compacted where required, uniformly and simultaneously on each side of the pipe in order to prevent lateral displacement of the pipe.
6. Under no circumstances shall the pipe embedment be disturbed or displaced after it has been adequately compacted by the moving or removal of trench boxes, or other equipment or personnel. If the pipe embedment is displaced, the contractor shall re-install those portions of the pipe laid which were disturbed.

1.15 BACKFILLING ABOVE PIPE EMBEDMENTS:

A. Except as otherwise permitted, trench backfill above previously compacted pipe embedment material shall conform to the material and placing requirements as follows.

B. Compacted Backfill:

C. Compacted backfill material shall have a moisture content such that the required density can be obtained by the compaction method used in each case. The limits of Compacted Backfill shall be as shown on the Construction Plans, or as stipulated below or as directed by the Engineer.
   1. 95% of maximum density: Under pavements, surfacings, driveways, curbs, gutters, walks or other surface construction, structures, under road or highway shoulders and locations which are within 4-feet of any structure. Compacted backfill shall be completed immediately after pipe placement.
   2. 90% of maximum density: Under established lawns or areas to sodded or seeded.
   3. Compacted backfill shall be completed within two (2) days of pipe placement unless the moisture content exceeds the optimum.
   4. The top portion of backfill beneath established sodded or cultivated areas shall be furnished with not less than 12 inches of topsoil.
   5. The material shall be placed in layers and compacted by means of suitable equipment or by tamping with mechanical tampers or hand tampers. Each layer shall be compacted to a density equal to or greater than the percentage of maximum density indicated. Each successive layer shall contain only that amount of material which will insure proper compaction, but in no case shall any layer be greater than eight (8) inches (loose measurement) for 95% density or twelve (12) inches (loose measurement) for 90% density. The moisture content of the soil to be used for backfill shall be uniform and shall be within plus or minus two percentage points of optimum moisture for the soil.

6. The Contractor will be required to obtain an independent laboratory to determine the standard proctor density of the soil prior to construction if it has not already been determined. The maximum density of the soil shall be determined by ASTM Designation: D 698. The Contractor will also be required to provide independent representatives to perform field density tests of the compacted backfill in accordance with ASTM Designation D 2922 (Nuclear Method). The tests shall be required to determine that the method of compaction being used by the Contractor achieves the specified density. The number of tests that required depends on the success and consistency of the Contractor in achieving the specified density. The Minimum number of tests to be performed shall be one for each 1000 feet of pipe laid, or fraction thereof and determined by the Engineer. The Engineer reserves the right to determine the locations of the tests. When the tests indicate that a specified density has not been accomplished, the Contractor shall re-work the area until a successful test is achieved. Cost of retesting due to failure shall be the responsibility of the Contractor. The Engineer or Owner reserves the right to test any portion of the job independent of the Contractor's testing representative.

D. Standard Backfill:
   1. Standard Backfill material above pipe embedments may be placed by any method or combination of methods, approved by the Engineer, which will cause the density of the backfill material to be approximately equal to the adjacent undisturbed material, which will not subsequently settle and cause a depression in the trench area and which will not impose excessive concentrated or unbalanced loads, shock or impact on, and which will not result in displacement of the installed pipe.
   2. Standard earth backfill material which is to be placed above embedments shall be free of brush, roots more than 2 inches in diameter, debris and junk, but may contain rubble and detritus from rock excavation, stones, and boulders, in certain portions of the trench depth as hereinafter provided.
   3. Compact masses of stiff, mucky clay, or gumbo, or other consolidated material more than one cubic foot in volume shall not be permitted to fall more than five feet into the trench unless cushioned by at least 2 feet of loose backfill above the specified pipe embedment.
   4. No standard trench backfill material containing rock, or rock excavation detritus, shall be placed in the upper 12 inches of the trench except with the specific permission of the Engineer in each case, nor shall any hard rock, or stone or boulder larger than 8 inches in its greatest dimension be placed within 2 feet of the top of pipe having a cover depth less than 10 feet, or within 3 feet of the top of pipe laid in deeper trenches. Large stones not exceeding 12 inches may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill settlement will result.

E. Hand Placed Backfill: All hand placed backfill shall be deposited and spread with tools in uniform layers not more than 12 inches in thickness on each side of the pipe and for the full width of the trench where above the pipe.

F. Inundated Sand Backfill: Inundated sand backfill shall only be used with express permission from the Engineer. Sand used for inundated sand backfill shall be free of lumps, rubbish, roots, cinders, and other objectionable material. Backfill sand shall contain not more than 10 percent by weight of clay and loam combined, not more than 5 percent shall be retained on a No. 4 sieve, and not more than 20 percent shall pass a No. 100 sieve.
   1. The general procedure to be employed in the inundation of sand backfill with water shall be submitted by the Contractor to, and approved by, the Engineer prior to starting operations thereunder. Operational details in connection therewith shall be acceptable to the Engineer at all times.
   2. Unless otherwise authorized by the Engineer, an adequate supply of water shall be available at the site of each water-settled sand fill to completely inundate the sand to the top of the trench, or structure subgrade, in one uninterrupted operation. However, in order to reduce the loss of water by seepage into a porous subsoil, the Engineer may permit stage inundation of successive layers of sand in the trench.

3. No compacted backfill shall be installed in freezing weather except by permission of the Engineer, and in no case shall backfilling be done with frozen material or on material already frozen in the trench.
4. Backfill meeting the above requirements may be done prior to specified pipe line testing, at the Contractor's option. This will be allowed to prevent displacement of the pipe during testing operations. Should the pipe not withstand the hydrostatic testing as outlined in these specifications, the Contractor shall be required to uncover, correct and backfill the pipe without additional cost to the Owner.

1.16 EXCAVATION FOR STRUCTURES:

A. Excavation for structures shall meet the requirements of SECTION: EXCAVATION FOR STRUCTURES.

1.17 STRUCTURE BACKFILL:

A. Backfill material around and outside of structures shall be of a type, and placed and compacted as specified for the trench backfill adjacent thereto.

1.18 DRAINAGE MAINTENANCE:

A. Backfilling of trenches for pipe installed beneath and/or across roadways, driveways, walks and other traffic ways adjacent to drainage ditches and water courses shall not be done prior to the completion of backfilling to the original ground surface of the trench on the upstream side of such trafficway in order to prevent the impounding of water at any point after the pipe has been laid, and all necessary bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained. Backfilling shall be done in such a manner that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other water course crossed by the line of trench shall be removed immediately after backfilling is completed and the section, grades and contours of such ditches or water courses restored to their original condition, in order that surface drainage will be obstructed no longer than necessary.

1.19 PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES:

A. Where trenches are constructed in or across ditches or other water courses the backfill shall be protected from surface erosion by adequate means. When the grade of the ditch exceeds one percent, suitable ditch checks as approved by the Engineer shall be installed as directed. Ditch checks may be of CCA treated lumber, stone, or concrete as authorized. In any case, the ditch check shall extend less than two (2) feet below the original ditch or water course bottom for the full bottom width and not less than eighteen (18) inches into the side slope thereof.

1.20 DISPOSAL OF EXCESS EXCAVATED MATERIALS:

A. Except as otherwise permitted or directed by the Engineer, all excess excavated materials shall be disposed of away from the site of the work.
B. Broken concrete and other coarse debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be and actually installed in trench backfill, junk and debris encountered in excavation work, and other similar waste materials shall be disposed of away from the site of the work.
C. The excess suitable material, and unsuitable material, shall be disposed of at locations approved by the Engineer and/or as indicated on the Plans. The material disposed of shall be spread in a neat appearance, and smooth enough as not to constitute a hazard to humans and animals. The final appearance shall be subject to the approval of the Engineer. If disposal is on private property, the Contractor shall obtain written permission of the property owner on whose property the material is to be placed. Copies of all agreements with property owners are to be furnished to the Engineer.

1.21 BORE WITHOUT ENCASEMENT:

A. Utility lines constructed at specific locations as designated on the Plans shall be installed without encasements and shall be placed by boring, or a combination of jacking and boring. The pipe shall be of the size and length as indicated on the Plans and installed accurately to line and grade. The minimum cover specified on the Plans shall be maintained. Working pits shall be excavated at each end of the bore and shall be adequately shored to prevent slipping or reveling of the embankment. The working pits shall be provided with sumps for dewatering.

B. The line and grade shall be checked at least once per shift as the work progresses.

C. After construction of the bore, the utility line shall be properly aligned, graded, and installed as indicated on the Plans.

1.22 BORE AND ENCASEMENT: Utility lines constructed at specific locations as designated on the Plans shall be installed without encasements and shall be placed by jacking and boring. The pipe shall be of the size and length as indicated on the Plans and installed accurately to line and grade. The minimum cover specified on the Plans shall be maintained. Working pits shall be excavated at each end of the bore and shall be adequately shored to prevent slipping or reveling of the embankment. The working pits shall be provided with sumps for dewatering.

A. The pipe supports shall be accurately placed as the carrier pipe enters the encasement pipe.

B. After construction of the bore, the utility line shall be properly aligned, graded, and installed as indicated on the Plans.

C. Installation of the specific utility line in the pipe encasement and material for the pipe encasement shall meet the requirements specified on the Plans.

1.23 STREETS AND ROADWAY CROSSINGS:

A. Pipelines constructed under streets and roadways may be constructed by open cut trenching at specific locations designated on the Plans. The Contractor shall install suitable barricades and lights at open trenches and take any precautions necessary to protect the public from damage as a result of the construction operations. The Contractor shall comply with the Manual on Uniform Traffic Control Devices for Streets and Highways, when controlling the traffic at these locations as set forth in SECTION: SUPPLEMENTARY CONDITIONS.

1.24 INTERRUPTION OF TRAFFIC:

A. Interruption of through traffic on City streets will be kept to a minimum and provisions shall be made to permit local traffic to serve residents in the vicinity of the work at all times as outlined in the SECTION: SUPPLEMENTARY CONDITIONS.

B. The Contractor will be financially responsible for any damage or suits arising from street and road crossings and shall save and hold harmless the Owner, utility Owner and the Engineer from any claims arising from this construction.

1.25 PROTECTION OF TREES AND SHRUBBERY:

A. Only those trees shown on the Plans or as directed by the Engineer shall be protected.

B. Main tree roots shall not be cut except where they fall within the area to be occupied by the pipe. Excavation shall be done by hand where necessary to prevent injury to roots or trees. Trees which are left standing shall be adequately protected from permanent damage by reason of construction operations.

1.26 FINISH GRADING:

A. The Contractor shall finish grade all disturbed areas to a degree acceptable for the application of seed, fertilizer, and mulch as required below.

B. General: Equipment necessary for the proper preparation of the ground surface and for handling and placing all required materials shall be on hand, in good condition, and shall be approved before the work is started.

C. Clearing: Prior to grading and tillage operations, vegetation on the site that might interfere with grading, tillage, or seeding operations shall be mowed, grubbed, raked and burned or removed from the site and the ground surface cleared of stumps, stones, roots, cable, wire, grade stakes, and other materials that might hinder proper grading, tillage, seeding, or subsequent maintenance operations.

D. Grading: Grades that have been previously established, as shown on the Plans, shall be maintained in a true and even condition. Maintenance shall include necessary repairs to previously graded areas. Surfaces shall be left at the prescribed grades in an even and properly compacted condition so as to prevent the formation of depressions where water will stand.

E. Tillage: After the areas required to be treated have been brought to the grades shown on the Plans, the areas shall be thoroughly tilled to a depth of at least three inches by plowing, discing, harrowing, or other approved method until the condition of the soil is acceptable. The work shall be performed only during periods where beneficial results are likely to be obtained. When conditions are such, by reason of drought, excessive moisture, or other factors, that satisfactory results are not likely to be obtained, the work will be stopped and shall be resumed only when directed. Undulations or irregularities in the surface that would interfere with further construction operations or maintenance shall be leveled before the next specified operation.

F. Cleanup: After completion of the above operations, the surface shall be cleared of stones, stumps, or other objects larger than two inches in thickness or diameter, and of roots, brush, wire, grade stakes, and other objects that might be a hindrance to maintenance operations. Paved areas over which hauling operations are conducted shall be kept clean, and soil or other dirt that may be brought upon the surface shall be removed promptly. The wheels of vehicles shall be cleaned to avoid bringing dirt upon the surface of roads and other paved areas. Cleaning operations shall be conducted with care to prevent damage to underlying pavement.

1.27 FIELD QUALITY CONTROL:

A. Top Surface of Backfilling under Paved Areas: Plus or minus ½-inch from required elevations.

B. Field inspection and testing will be performed under provisions of SECTION: TESTING SERVICES.

C. Moisture-density relation tests of fill material will be performed in accordance with ANSI/ASTM D 698 and with SECTION: TESTING SERVICES.

D. Compaction testing will be performed in accordance with ASTM 2922 and with SECTION: TESTING SERVICES.

E. During construction of embankments or backfills or preparation of subgrade soil, moisture content shall be determined in accordance with ASTM D 2216 or ASTM D 3017.

F. If tests indicated Work does not meet specified requirement, the Contractor shall remove Work, replace and retest at no cost to the Owner.

G. Frequency of Tests: Trench Backfill: One per lift per 500 linear feet or one per lift in shorter runs.

H. Recompact fills subjected to vehicular traffic.

END OF SECTION 02220

SECTION 02222

EXCAVATING

PART 1 - GENERA

1.01 SECTION INCLUDES
- A. Excavating for building foundations and footings.
- B. Excavating for slabs-on-grade, paving, landscaping.
- C. Excavating for site structures.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 PREPARATION
- A. Identify required lines, levels, contours, and datum.
- B. Locate, identify, and protect utilities that remain, from damage.
- C. Notify utility company to remove and relocate utilities.
- D. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- E. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

3.02 EXCAVATION
- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Excavate subsoil required to accommodate building foundations, slabs-on-grade, paving and site structures, construction operations.
- C. Machine slope banks to angle of repose or less, until shored.
- D. Do not interfere with 45 degree bearing splay of foundation.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- F. Hand trim excavation. Remove loose matter.
- G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
- H. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- I. Correct areas over-excavated in accordance with Section 02223.
- J. Stockpile excavated material in area designated on site and remove excess material not being reused, from site.

3.03 FIELD QUALITY CONTROL
- A. Field inspection will be performed under provisions of the General Requirements.
- B. Provide for visual inspection of bearing surfaces.

3.04 PROTECTION
- A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

END OF SECTION 02222

SECTION 02223

BACKFILLING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Building perimeter and site structure backfilling to subgrade elevations.
- B. Site filling and backfilling.
- C. Fill under slabs-on-grade, paving.
- D. Consolidation and compaction as scheduled.
- E. Fill for over-excavation.

1.02 REFERENCES
- A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

PART 2 PRODUCTS

2.01 FILL MATERIALS
- A. Fill: As specified in Section 02205.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify subdrainage, dampproofing, or waterproofing installation has been inspected and completed.

3.02 PREPARATION
- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify and proof roll subgrade surface to a depth of 8 to 12 inches to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.03 BACKFILLING
- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Fill, Place and compact materials in continuous layers not exceeding 8 inches compacted depth.
- D. Employ a placement method that does not disturb or damage other work.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density. Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.
- F. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- G. Slope grade away from building minimum 2 inches in 10 ft. unless noted otherwise.
- H. Make gradual grade changes. Blend slope into level areas.
- I. Remove surplus backfill materials from site.
- J. Leave fill material stockpile areas free of excess fill materials.

3.04 TOLERANCES
- A. Top Surface of Backfilling under Paved Areas: Plus or minus 1 inch from required elevations.
- B. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.05 FIELD QUALITY CONTROL
- A. Field inspection and testing will be performed under provisions of the General Requirements.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D698.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest at no additional cost to the Owner.
- D. Proof roll compacted fill surfaces under slabs-on-grade, and paving.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of the General Requirements.
B. Reshape and re-compact fills subjected to vehicular traffic.

3.07 SCHEDULE

A. Interior Slab-On-Grade:
   1. Fill compacted to 95 percent standard density.
   2. 4" sand base.
B. Exterior Side of Foundation Walls Retaining Walls and Over Granular Filter Material and Foundation Perimeter Drainage:
   1. Fill to subgrade elevation, each lift, compacted to 90 percent.
C. Fill Under Grass Areas:
   1. Fill to 4 inches below finish grade.
D. Fill Under Asphalt or Concrete Paving:
   1. Compact subsoil to 95 percent of its maximum dry density.
E. Fill to Correct Overexcavation:
   1. Lean concrete to minimum compressive strength of 1000 psi.
   2. Compact approved fill to 95 percent of its maximum dry density.

END OF SECTION 02223

SECTION 02225

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Excavating trenches for utilities from 5 feet outside building to municipal utilities.
- B. Compacted fill from top of utility bedding to subgrade elevations to 95 percent standard density.
- C. Backfilling and compaction.

1.02 REFERENCES
- A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

1.03 FIELD MEASUREMENTS
- A. Verify that survey bench mark and intended elevations for the Work are as shown on drawings.

1.04 COORDINATION
- A. Coordinate all work as required.
- B. Verify work associated with lower elevation utilities are complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.01 FILL MATERIALS
- A. Fill: As specified in Section 02205.

PART 3 EXECUTION

3.01 PREPARATION
- A. Identify required lines, levels, contours, and datum.
- B. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.
- D. Maintain and protect above and below grade utilities which are to remain.
- E. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with fill and compact to density equal to or greater than requirements for subsequent backfill material.

3.02 EXCAVATION
- A. Excavate subsoil required for utilities to municipal utilities.
- B. Cut trenches sufficiently wide to enable installation and allow inspection.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Hand trim excavation. Remove loose matter.
- E. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
- F. Correct areas over excavated in accordance with Section 02222.
- G. Stockpile excavated material in area designated on site and remove excess material not being used, from site.

3.03 BACKFILLING
- A. Backfill trenches to contours and elevations with unfrozen materials. All areas under pavement or adjacent to pavement shall be compacted to 95 percent standard density.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
C. Granular Fill: Place and compact materials in continuous layers not exceeding 8 inches compacted depth.
D. Soil Fill: Place and compact material in continuous layers not exceeding 8 inches compacted depth.
E. Employ a placement method that does not disturb or damage foundation perimeter drainage, conduit, or pipes in trench.
F. Maintain optimum moisture content of fill materials to attain required compaction density.
G. Remove surplus fill materials from site.
H. Leave fill material stockpile areas completely free of excess fill materials.

3.04 TOLERANCES
A. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

3.05 FIELD QUALITY CONTROL
A. Field inspection and testing will be performed under provisions of the General Requirements.
B. Compaction testing will be performed in accordance with ANSI/ASTM D698.
C. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest at no additional cost to the owner.

3.06 PROTECTION OF FINISHED WORK
A. Protect or reshape and recompact fills subjected to vehicular traffic during construction.

END OF SECTION 02225

SECTION 02260

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes temporary excavation support and protection systems. **Contractor is responsible for all excavation support and protection systems as required by local, state, and OSHA regulations.**

B. Related Sections:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.

1.3 PERFORMANCE REQUIREMENTS

A. Furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Prevent surface water from entering excavations by grading, dikes, or other means.
2. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
3. Monitor vibrations, settlements, and movements.

B. Excavation support and protection must comply with ASHA, state and local requirements.

1.4 QUALITY ASSURANCE

A. Preinstallation:

1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
   a. Geotechnical report.
   b. Existing utilities and subsurface conditions.
   c. Proposed excavations.
   d. Proposed equipment.
   e. Monitoring of excavation support and protection system.
   f. Working area location and stability.
   g. Coordination with waterproofing.
   h. Abandonment or removal of excavation support and protection system.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Shotcrete: Comply with Division 3 Section "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.

C. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

END OF SECTION 02260

SECTION 02700

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Concrete sidewalks, ramps, parking lot, drives, curbs, and gutters.

1.02 PERFORMANCE REQUIREMENTS
A. Paving: Designed for parking and regular-duty commercial vehicles.

1.03 QUALITY ASSURANCE
A. Perform work in accordance with ACI 301, requirements of Sections 03100, 03200 and 03300.
B. Obtain cementitious materials from same source throughout.

1.04 ENVIRONMENTAL REQUIREMENTS
A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 FORM MATERIALS
A. Wood or Steel form material, profiled to suit conditions.
B. Joint Filler: ANSI/ASTM D1751 type; 3/4 inch thick.

2.02 REINFORCEMENT
A. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; 6x6-W2.9 x W2.9 in flat sheets or coiled rolls; unfinished.
B. Reinforcing Steel: ASTM A615; 40 or 60 ksi yield grade; deformed billet steel bars; unfinished.

2.03 CONCRETE MATERIALS
A. Cement: ASTM C150 Air Entraining - Type IA Portland type, natural color.
B. Fine and Coarse Mix Aggregates: ASTM C33.
C. Water: Potable, not detrimental to concrete.
D. Air Entrainment: ASTM C260.
E. Chemical Admixture: ASTM C494, as approved by architect.

2.04 CONCRETE MIX - BY PERFORMANCE CRITERIA
A. Mix concrete in accordance with, ACI 304. Deliver concrete in accordance with ASTM C94.
B. Provide concrete to the following criteria:
   1. Compressive Strength: Reference schedule below.
   2. Slump: 3 to 4 inches.
   3. Minimum Water/Cement Ratio: 6.5 gallon/6 sack.
   4. Air Entrained: 6 percent (+- 2 percent).
C. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
D. Use calcium chloride only when approved by Architect/Engineer.
E. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

2.05 SOURCE QUALITY CONTROL
A. Submit proposed mix design of each class of concrete to the architect and appointed testing laboratory firm for review prior to commencement of work.
B. Tests on cement and aggregates shall be performed to ensure conformance with specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify compacted subgrade, granular base and stabilized soil is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 PREPARATION
- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manholes, catch basins, and frames with oil to prevent bond with concrete pavement.
- C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.03 FORMING
- A. Place and secure forms to correct location, dimension, and profile.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 REINFORCEMENT
- A. Place reinforcement at mid-height of slabs-on-grade.
- B. Interrupt reinforcement at expansion joints.
- C. Place dowels and reinforcement to achieve pavement and curb alignment as detailed.
- D. Provide doweled joints 12 inch o.c. at interruptions of concrete.

3.05 PLACING CONCRETE
- A. Place concrete in accordance with ACI 301.
- B. Ensure reinforcement, inserts and embedded parts are not disturbed during concrete placement.
- C. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- D. Place concrete to indicated pattern.

3.06 JOINTS
- A. Place 1 inch expansion joints at 50 foot intervals or more frequently as noted on drawings. Align curb, gutter, and sidewalk joints. Seal all expansion joints with self-leveling sealant.
- B. Where concrete abuts building provide 1/2” expansion joint with joint filler and self-leveling sealant.
- B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant placement by Section 07900.
- C. Provide scored or sawn joints at intervals equal to sidewalk width, unless noted otherwise. Scored and sawn joints at curbs and parking lots shall be at 10 feet on-center each way.
- D. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.07 FINISHING
- A. Parking: Light broom.
- B. Sidewalk Paving: Light broom, radius to 1/4 inch and trowel joint edges.
- C. Handicapped Ramps: Reference ADA. Sloped sections shall have raised circular texture. Contractor may install pre-manufactured pavers or fiberglass forms in lieu of cast in place concrete.
- D. Curbs and Gutters: Trowel finish.
- E. Inclined Vehicular Ramps: Broom perpendicular to slope.
- F. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.08 FIELD QUALITY CONTROL
- A. Four concrete test cylinders shall be taken for every 100 or less cu yds of each class of concrete placed each day.
- B. One additional test cylinder shall be taken during cold weather and cured on site under same conditions as concrete it represents.
- C. One slump test shall be taken for each set of test cylinders taken.

3.09 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

3.10 SCHEDULES

A. Concrete sidewalks, ramps, curb and gutter: 4,000 psi 28 day concrete, 4 inches thick, 6x6 – W2.9 x W2.9 W.W.F. reinforced, natural color Portland cement, broom finish, detectable warnings per ADA at ramps and curb cuts.

B. Concrete Parking Lots and Drives:
Regular duty: 4,000 psi 28 day concrete, 5 inches thick, natural color, Portland cement, broom finish.

END OF SECTION 02700

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Formwork for cast-in place concrete, with shoring, bracing, and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.02 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site per the suppliers and/or manufacturer's recommendations.
- B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.03 COORDINATION
- A. Coordinate this Section with other Sections of work which require attachment of components to formwork.
- B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS
- A. Form Materials: At the discretion of the Contractor.

2.02 PREFABRICATED FORMS
- A. Preformed Steel Forms: Minimum gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.03 FORMWORK ACCESSORIES
- A. Form Ties: Removable or Snap-off type, metal, size and shape to minimize filling, waterproofing, and refinishing concrete surfaces.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Corners: Chamfer, exposed edges 1/2 inch unless otherwise noted or detailed on the drawings.
- D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, release tape sealed slots, anchors for securing to concrete formwork.
- E. Flashing Reglets: Galvanized steel 22 gage thick, longest possible lengths, with alignment splines for joints, release tape sealed slots, anchors for securing to concrete formwork.
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- G. Waterstops: Rubber Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth forms if permitted, hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.
B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
D. Align joints and make watertight. Keep form joints to a minimum.
E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
F. Provide chamfer strips on external corners of beams joists columns and exposed decorative concrete edges.
G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.
B. Locate and set in place items which will be cast directly into concrete.
C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
D. Position recessed reglets for brick veneer masonry anchors to spacing and intervals specified in Section 04300.
E. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
F. Install waterstops continuous without displacing reinforcement. Heat seal joints watertight.
G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.
B. Clean formed cavities of debris prior to placing concrete.
C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301

3.08 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION 03100

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

1.02 SUBMITTALS
A. Submit under provisions of the General Requirements.
B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

1.03 QUALITY ASSURANCE
A. Perform Work in accordance with CRSI - Manual of Standard Practice and ACI 301.

1.04 COORDINATION
A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.01 REINFORCEMENT
A. Reinforcing Steel: ASTM A615, 60 yield grade as indicated on the drawings; deformed billet steel bars, unfinished.
B. Reinforcing Steel Plain Bar and Rod Mats: ASTM A704, ASTM A615, Grade 60 as indicated on the drawings; steel bars or rods, unfinished.
C. Stirrup Steel: ANSI/ASTM A82, unfinished.
D. Welded Steel Wire Fabric: ASTM A815; in flat sheets; unfinished.

2.02 ACCESSORY MATERIALS
A. Tie Wire: Minimum 16 gage annealed type.
B. Chairs, Bolsters, Bar Supports, Spacers: Metallic, sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required, as indicated on plans and details.

2.03 FABRICATION
A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
B. Weld reinforcement in accordance with ANSI/AWS D1.4.
C. Locate reinforcing splices not indicated on drawings, at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT
A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
B. Do not displace or damage vapor barrier.
C. Accommodate placement of formed openings.
D. Maintain concrete cover around reinforcing as indicated on the drawings or if not indicated as follows:

Item	Coverage
Beams	1 1/2 inch
Column Ties	1 1/2 inch
Walls (exposed to weather or backfill)	2 inch
Footings and Concrete Formed Against Earth	3 inch
Slabs on Fill	1 1/2 inch

END OF SECTION 03200

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Cast-in-place concrete footings, foundation walls.
- B. Floors and slabs on grade.
- C. Control, expansion, and contraction joint devices associated with concrete work, including joint sealants.
- D. Equipment pads and light pole base.

1.02 SUBMITTALS
- B. Product Data: Provide data on joint devices, attachment accessories.
- C. Samples: Submit 2-inch long samples of expansion/contraction joint.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.
- E. Concrete Mix Design Proportions.
  1. Submit as specified in Part 2, Paragraph 2.05 F. Mix Proportions, this section, before placing concrete.
  2. Submit for each mix design.
  3. Resubmit for any change in mix design.
  4. Submit backup test data to verify strengths in accordance with ACI 301 and 318.

1.03 PROJECT RECORD DOCUMENTS
- A. Accurately record actual locations of embedded utilities and components which are concealed from view.

1.04 QUALITY ASSURANCE
- A. Codes
  1. International Building Code.
  2. ACI Specifications for Structural Concrete Buildings.
  3. Perform Work in accordance with ACI 318 Building Code Requirements for Reinforced Concrete.
  4. Acquire cement and aggregate from same source for all work.
  5. Conform to ACI 305R when concreting during hot weather.
  6. Conform to ACI 306R when concreting during cold weather.
- B. Testing
  1. Employ acceptable testing laboratory to perform materials evaluation, testing, and design of concrete mixes. Testing shall comply with:

Sampling:	ASTM C 172
Slump	ASTM C 143 (4” to 6” slump)
Air Content:	ASTM C 173
Compressive Strength	ASTM C 39

  2. Concrete materials shall comply with these standards:

Portland Cement:	ASTM C 150, Type as required
Aggregates:	ASTM C 33
Water:	Potable
Air-Entraining Admixture:	ASTM C260
Water-Reducing Admixture:	ASTM C 494
Membrane-Forming Curing Compound:	ASTM C 309, Type I
Deformed Reinforcing Bars:	ASTM A 615, Grade 60
Welded Wire Fabric:	ASTM A 185
Ready-Mix Concrete:	ASTM C 94
Placement in Cold Weather:	ACI 306
Placement in Hot Weather:	ACI 305

1.05 COORDINATION
- A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS
- A. Cement: ASTM C150, Type I - Normal or Type III - High Early Strength Type V - Sulfate Resistant as required Portland type.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.02 ADMIXTURES
- A. Air Entrainment: Per ASTM C260 at footings and foundations, **not allowed at slab / floor**.
- B. Chemical: ASTM C494 Type A - Water Reducing, Type B - Retarding, Type C - Accelerating, Type D - Water Reducing and Retarding, Type E - Water Reducing and Accelerating.

2.03 ACCESSORIES
- A. Bonding Agent: Polymer resin emulsion, polyvinyl acetate, Latex emulsion, two component modified epoxy resin, non-solvent two component polysulfide epoxy, mineral filled polysulfide polymer epoxy, mineral filled polysulfide polymer epoxy resin, or Polyamid cured epoxy as approved.
- B. Vapor Barrier: 15 mil thick clear polyethylene film.
- C. Non-Shrink Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.
- D. Curing Compound: Liquid membrane-forming compound conforming to ASTM C 309, Type 1. Curing compound used on floors to be sealed, painted, tiled, or covered with resilient floor covering shall be guaranteed not to interfere with application of sealers, paint, tile mortar, or tile adhesive after 28-day curing period. Areas to receive carpet tile and VCT flooring shall receive Aquron 2000 Cure and Seal.

2.04 JOINT DEVICES AND FILLER MATERIALS
- A. Joint Filler:
  1. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 inch thick.
  2. Joint Filler Type B: ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.
- B. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient elastomeric, vinyl, or neoprene, filler strip with a Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum or vinyl cover plate, of longest manufactured length at each location, recess mounted; color as selected.
- C. Sealant: Rubber or synthetic rubber compound.

2.05 CONCRETE MIX
- A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
- B. Select proportions for normal weight concrete in accordance with ACI 301.
- C. **Reference Structural General Notes on Sheet S0.1 for mix designs.**
- D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
- E. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.
- F. Mix Proportions.
  1. Concrete shall be homogeneous, readily placeable, and uniformly workable; proportioned to conform to ACI 211.1.
  2. Mix proportions for all concrete shall be selected preferably on the basis of field experience, but in the case where sufficient or suitable strength test data is not available, concrete shall be proportioned on the basis of laboratory trial mix design. Designs shall conform to ACI 301.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify requirements for concrete cover over reinforcement.
- B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.02 PREPARATION
- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Use forms for all concrete except footings may be earth formed. Adequately brace and stiffen forms to prevent deflection and settlement.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.
B. Notify Architect/Engineer minimum 24 hours prior to commencement of operations.
C. Ensure reinforcement, inserts, embedded parts, formed expansion, and contraction joints are not disturbed during concrete placement.
D. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by sealant applied between overlapping edges and ends or taping edges and ends.
E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.
F. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.
G. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
H. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.
I. Install joint devices in accordance with manufacturer's instructions.
J. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
K. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.
L. Install joint covers in longest practical length, when adjacent construction activity is complete.
M. Apply sealants in joint devices in accordance with Section 07900.
N. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
O. Place concrete continuously between predetermined expansion, control, and construction joints.
P. Do not interrupt successive placement; do not permit cold joints to occur where possible.
Q. Place floor slabs in saw cut pattern indicated. Cut joints with power blade as soon as concrete surface is firm enough to resist tearing or damage by the blade and before random shrinkage cracks can occur (Usually required 4 to 12 hours after finishing).
R. Saw-cut joint - Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
S. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.
T. Place concrete on properly prepared and unfrozen subgrade and only in dewatered excavations.

3.04 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed concrete walls columns beams joists with smooth rubbed finish.
B. Finish concrete floor surfaces in accordance with ACI 301.
C. Wood float surfaces which will receive quarry tile, ceramic tile, or terrazzo with full bed setting system.
D. Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring, thin set quarry tile, or thin set ceramic tile.
E. Steel trowel surfaces which are scheduled to be exposed.
F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/4 inch per foot or as indicated on drawings.

3.05 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
D. Cure floor surfaces in accordance with ACI 308.
E. At areas scheduled to receive stained concrete floor finish, use only curing components and methods approved by the stain manufacturer.
F. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 4 days.
G. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
H. Curing Compound: Cure with liquid membrane-forming compound conforming to ASTM C 309, Type I. Apply immediately after removal of forms (which have been continuously wet); or in case of a slab, after the concrete has been finished and is hardened sufficiently to walk on. Apply curing compound to all exposed surfaces immediately after removing form or after finishing concrete.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of the General Requirements.
B. Provide free access to Work and cooperate with appointed firm.
C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
D. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
E. Three concrete test cylinders will be taken for every 75 or less cu yds of each class of concrete placed. If 4" diameter cylinders are used, an additional cylinder shall be tested at 28 days.
F. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
G. One slump test will be taken for each set of test cylinders taken.
H. Water added to concrete having a slump below the specified minimum shall be at Contractor's risk. If the water added produces a slump greater than the specified maximum, the concrete will be rejected. If water is added, the concrete shall be remixed for a minimum of 25 revolutions. Three concrete test cylinders will be taken from every truck that water is added to at the jobsite.

3.07 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
C. Patch imperfections as directed or in accordance with ACI 301.

3.08 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.
C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION 03300

SECTION 04100

MORTAR AND MASONRY GROUT

PART 1 GENERAL

A. Mortar and grout for masonry.

1.02 GENERAL
A. All notes or specifications on structural drawings shall override any discrepancies listed.

1.03 SUBMITTALS
A. Submit under provisions of the General Requirements.
B. Include design mix, indicate whether the Proportion or Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

1.04 QUALITY ASSURANCE
A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle products to site under provisions of the General Requirements.
B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 ENVIRONMENTAL REQUIREMENTS
A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MATERIALS
A. Portland Cement: ASTM C150, Type I, match existing color.
B. Masonry Cement: ASTM C91, Type S, match existing color.
C. Premix Mortar: ASTM C387, Type S, match existing color.
D. Mortar Aggregate: ASTM C144, standard masonry type.
E. Hydrated Lime: ASTM C207, Type S.
F. Water: Clean and potable.
G. Bonding Agent: Latex or Epoxy type.
H. Integral Liquid Polymeric Water-Repellant Mortar Admixture: Mix with mortar during mixing, capable of achieving a Class E rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria found in ASTM E 514-74. There should be no decrease in concrete masonry bond strength or compressive strength of prisms when compared to a control when tested according to ASTM C 1357 and ASTM C 1314 respectively. Provide product listed below, or approved equal:
   1. Dry Block Integral Liquid Polymeric Water-Repellent Mortar Admixture manufactured by Grace Construction Products.

2.02 MORTAR COLOR AND STYLE
A. Mortar Color: **Architect to select from manufacturer's full range of colors.**

2.03 MORTAR MIXES
A. Mortar For Load Bearing Walls and Partitions: ASTM C270, Type S using the Property specification.
B. Mortar For Non-Load Bearing Walls and Partitions: ASTM C270, Type N using the Property specification.
C. Mortar For Engineered Masonry: ASTM C270, Type S using the Property specification.
D. Pointing Mortar: ASTM C270, Type N or O using the Property specification.

2.04 MORTAR MIXING

A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
B. Maintain sand uniformly damp immediately before the mixing process.
C. Add mortar color and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
D. Do not use anti-freeze compounds to lower the freezing point of mortar.
E. If water is lost by evaporation, re-temper only within two hours of mixing.
F. Use mortar within two hours after mixing at temperatures of 90 degrees F (32 degrees C), or two-and-one-half hours at temperatures under 40 degrees F.

2.05 GROUT MIXES

A. Bond Beams, and Lintels: 2,000 psi strength at 28 days; 8-10 inches slump; premixed type in accordance with ASTM C476.
B. Engineered Masonry: 2,000 psi strength at 28 days; 8-10 inches slump; premixed type in accordance with ASTM C476.

2.06 GROUT MIXING

A. Mix grout in accordance with ASTM C270 and C476.
B. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
C. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 EXAMINATION

A. Request inspection of spaces to be grouted.

3.02 INSTALLATION

A. Install mortar and grout in accordance with premix mortar manufacturer's instructions.
B. Install mortar and grout in accordance with ASTM C270.
C. Work grout into masonry cores and cavities to eliminate voids.
D. Do not install grout in lifts greater than 16 inches or two CMU courses without consolidating grout by rodding.
E. Do not displace reinforcement while placing grout.
F. Remove excess mortar from grout spaces.

3.03 FIELD QUALITY CONTROL

A. Test and evaluate mortar in accordance with ASTM C780.
B. Test and evaluate grout in accordance with ASTM C1019.

END OF SECTION 04100

SECTION 04300

UNIT MASONRY SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Concrete masonry units.
- B. Reinforcement, anchorage, and accessories.

1.02 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Product Data: Provide data for masonry units and fabricated wire reinforcement.

1.03 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site under provisions of the General Requirements.
- B. Accept units on site. Inspect for damage.

1.05 ENVIRONMENTAL REQUIREMENTS
- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.
- C. Hot Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot or Cold Weather Masonry Construction.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS
- A. Hollow Load and Non-Load Bearing Block Units (CMU): Lightweight units, typical. All exterior exposed concrete masonry units and mortar shall contain integral water repellent. Units shall comply with ASTM C 33 and ASTM C 90, grade N water permanence per ASTM E 514 test. Wind driven protection per ASTM E 514-74, Class E. Full wall flexural bond strength per ASTM E 72-74 all interior concrete masonry shall be grade S, Type I, moisture controlled units. **Reference Structural Drawing Notes for additional requirements.**
- B. Size and Shape: Nominal modular size of 4 x 8 x 16 inches and 8 x 8 x 16 inches. Provide special units for 90 degree corners, bond beams, lintels, and corners.

2.02 REINFORCEMENT AND ANCHORAGE
- A. Single and Multiple Wythe Joint Reinforcement: Truss type; steel wire, hot dip galvanized to ASTM A641 after fabrication, No. 9 side rods with No. 9 cross ties.
  - Manufacturers:
    - a) DUR-O-WALL
    - b) TRU-MESH
    - c) BET-R-WALL
- B. Reinforcing Steel: ASTM A615, 40 or 60 ksi yield grade, deformed billet bars, uncoated finish.

2.03 MORTAR AND GROUT
- A. Mortar and Grout: As specified in Section 04100.

2.04 ACCESSORIES
- A. Preformed Control Joints: Rubber, Neoprene, Polyvinyl chloride material. Provide with corner and tee accessories, heat or cement fused joints.
- B. Joint Filler: Closed cell polyvinyl chloride, polyethylene, polyurethane or rubber; oversized 50 percent to joint width; self expanding.
- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- D. Vapor Barrier: Fluid Applied Air Barrier.
- E. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

2.05 LINTELS
A. As detailed on drawings. All lintels shall be field painted to closely match adjacent masonry material.

PART 3 EXECUTION

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

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

3.03 COURSING
A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
1. Bond: Running unless otherwise indicated.
2. Coursing: One unit and one mortar joint to equal 8 inches in height.
3. Mortar Joints: Concave, unless noted otherwise.

3.04 PLACING AND BONDING
A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
B. Lay hollow masonry units with face shell bedding on head and bed joints.
C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
D. Remove excess mortar as work progresses.
E. Interlock intersections and external corners.
F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
H. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, cavity insulation vapor barrier adhesive is applied, or bitumen damp proofing is applied.
I. Isolate masonry partitions from vertical structural framing members with a control joint.
J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.05 REINFORCEMENT AND ANCHORAGE
A. Install horizontal joint reinforcement 16 inches o.c.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
C. Place joint reinforcement continuous in first and second joint below top of walls.
D. Lap joint reinforcement ends minimum 6 inches.
E. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.06 LINTELS
A. Install loose steel or precast concrete lintels over openings as indicated or detailed.
B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
C. Openings Up To 42 inches wide: Reference Structural drawings.
D. Openings From 42 inches Up To 78 inches Wide: Reference Structural drawings.
E. Openings Over 78 inches: Reference Structural drawings.
F. Do not splice reinforcing bars.
G. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
H. Place and consolidate grout fill without displacing reinforcing.
I. Allow masonry lintels to attain specified strength before removing temporary supports.
J. Maintain minimum 8 inch bearing on each side of opening.

3.07 GROUTED COMPONENTS

A. Reinforce bond beam as indicated or detailed.
B. Lap splices minimum 24 bar diameters.
C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
D. Place and consolidate grout fill without displacing reinforcing.
E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.08 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.
B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
D. Size control joint in accordance with Section 07900 for sealant performance.
E. Form expansion joint as detailed.

3.09 BUILT-IN WORK

A. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, fireplace accessories, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
B. Install built-in items plumb and level.
C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
D. Do not build in organic materials subject to deterioration.

3.10 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.
B. Maximum Variation from Unit to Adjacent Unit: 1/32 inch.
C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.11 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING

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

3.13 PROTECTION OF FINISHED WORK

A. Protect finished Work.
B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION 04300

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Structural steel framing members and support members.
B. Base plates.
C. Grouting under base plates.

1.02 GENERAL
A. All notes or specifications on structural drawings shall override any discrepancies listed.

1.03 SUBMITTALS
A. Submit under provisions of the General Requirements.
B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, and fasteners.
   2. Connections and Connections not detailed.
   3. Cambers, and loads.
   4. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
   5. The Engineer prepared Contract Drawings cannot be used as Erection Drawings.
C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE
A. Fabricate and erect structural steel members in accordance with AISC - Manual of Steel Construction, Allowable Stress Design, Ninth Edition.
B. Perform Work in accordance with AISC - Specification for Architectural Exposed Structural Steel.
C. High strength bolts shall comply with Specification for Structural Forms using ASTM A 325.

1.05 QUALIFICATIONS
A. Fabricator: Company specializing in performing the work of this Section with minimum 5 years' documented experience.
B. Erector: Company specializing in performing the work of this Section with minimum 5 years' documented experience.
C. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Kansas.

1.06 FIELD MEASUREMENTS
A. Verify that field measurements are as shown on shop drawings and/or as instructed by the manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS
A. Reference drawings and notes on the drawings.

2.02 FINISH
A. Prepare structural component surfaces in accordance with SSPC SP 2.
B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete or high strength bolts.

2.03 SHOP CONNECTIONS
A. Weld or bolt at Contractor's option except when otherwise indicated or specified.
B. Shop portions of connections may be welded equivalent to any bolted connection specified if Engineer concurs.
C. Welded connections shall be as indicated or in accordance with acceptable alternative designs.

1. Welds of connection angles to beam webs shall conform to AISC Manual, Part 4, Tables III and IV, with particular regard for minimum web thickness. Provide longer connection angles or reinforce web as required.
2. All butt-joint groove welds shall be complete penetration welds unless otherwise indicated and shall conform to the applicable standards in AISC Manual, Part 4, with special emphasis on maintaining root opening.

D. Bolted connections shall conform with AISC Manual, Part 4:
1. All bolted connections shall be made with ¾-inch bolts, nuts, and washers unless otherwise indicated or specified.
2. Connections must be selected to support one-half the total uniform load capacity shown in the Allowable Uniform Load Tables, Part 2 of the AISC Manual, for the given beam, span and grade of steel specified.
3. Use the minimum number of rows of bolts for beam connections so that the bottom row is at or below the centerline of the beam.

2.04 FIELD CONNECTIONS
A. Provide with bolted connections unless otherwise indicated or specified.
B. Provide for field welding only when so indicated or when detail clearances make bolting impractical.
C. Bolted connections shall comply with Part 2.03 Paragraph D, this specification.

2.05 CONCRETE ANCHORS
A. Manually expanded and adhesive anchor types.
B. Furnish sizes indicated and install to conform to manufacturer's printed instruction.
C. Carbon steel grades and surface plating (or galvanizing) shall be manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 ERECTION
A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing and decking.
B. Field weld components indicated on Drawings and/or shop drawings.
C. Do not field cut or alter structural members without approval of Architect/Engineer.
D. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
E. Grout under base plates as indicated. Cut off exposed edges of grout at 45 degrees along the edges of the base plates after grout has acquired its initial set.
F. Frame floor, roof openings greater than 12 inches with supplementary framing.

3.03 CONNECTIONS
A. All bracing connections shall be bolted slip critical type. All other connections shall be pretensioned.
B. Where required for connection fit-up, bolt holes may be adjusted in one of the following manners: (flame cutting or flame enlargement of holes is not allowed):
1. Reamed to AISC allowable maximum size for oversized holes.
2. Holes may be filled with weld metal, ground smooth, and field-drilled.
3. Other Engineer-approved methods.

C. Make welded connections as indicated and leave all erection bolts in place after completion of welding unless otherwise indicated. Reinforce connections when members requiring fillet welds are not in contact. Use backup bars or spacer bars on all butt welds where root opening exceeds 3/16-inch. Remove all run-out tabs.

3.04 CONCRETE ANCHORS
A. Install anchors to conform to manufacturer's printed instructions.
B. The hole tolerances, drill bits, and anchor installation torque shall be as per manufacturer's printed recommendations.

3.05 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

END OF SECTION 05120

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes:
  1. Load-bearing wall framing.
  2. Interior non-load-bearing wall framing.

1.2 ACTION SUBMITTALS
- A. Product Data: For the following:
  1. Cold-formed steel framing materials.
  2. Load-bearing wall framing.
  3. Exterior non-load-bearing wall framing.
  4. Interior non-load-bearing wall framing.
  5. Single deflection track.
  6. Double deflection track.
  7. Drift clips.
  8. Post-installed anchors.
  9. Power-actuated anchors.
- 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.

1.3 INFORMATIONAL SUBMITTALS
- A. Welding certificates.
- B. Product certificates.
- C. Product test reports.
- D. Research Reports:
  1. For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE
- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency.
- 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."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
- A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S200 and ASTM C955, Section 8.

2.2 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 A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: ST33H AND ST50H As indicated on the Drawings
   2. Coating: G60

2.3 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: 0.0428 inch and as indicated on Drawings
   2. Flange Width: 1-5/8 inches.
B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and matching minimum base-metal thickness of steel studs.
C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch and as indicated on Drawings.
   2. Flange Width: 1-5/8 inches

2.4 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
   2. Flange Width: 1-5/8 inches
B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
C. Vertical Deflection Clips, Interior: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.
E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, 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.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
B. 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 AC193 or ICC-ES AC308 as appropriate for the substrate.
   1. Uses: Securing cold-formed steel framing to structure.
C. 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.
D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 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 cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. 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.

F. Frame both sides of joints.

G. Install insulation, specified in Section 072100 "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.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: 16 inches

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track.

1. Fasten both flanges of studs to top and bottom tracks.

2. Space studs as follows:

a. Stud Spacing: 16 inches

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
    1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
    2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
    1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
I. Install horizontal bridging in stud system, spaced vertically 48 inches Fasten at each stud intersection.
    1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
    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.
J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

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: 16 inches
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 single deep-leg deflection tracks and anchor to building structure.
    2. Install double deep-leg deflection tracks and anchor outer track to building structure.
    3. Connect vertical deflection clips to studs and anchor to building structure.
    4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
E. Install horizontal bridging in wall studs, spaced vertically not more than 48 inches 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. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking as indicated in drawings.

G. 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 INSTALLATION 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 and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will 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. Post installed anchors shall be inspected.
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.

END OF SECTION 054000

SECTION 05520

HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Handrails and fittings.

1.02 DESIGN REQUIREMENTS
A. Railing assembly, wall rails, and attachments to resist lateral force of 75 lbs. at any point without damage or permanent set.

1.03 SUBMITTALS
A. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.04 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.01 STEEL RAILING SYSTEM
A. Rails and Posts: As detailed and indicated on the drawings.
B. Fittings: Elbows, T-shapes, wall brackets, escutcheons; machined steel.
C. Mounting: Adjustable brackets and flanges. Prepare backing plate for mounting in wall construction.
D. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.02 FABRICATION
A. Fit and shop assemble components in largest practical sizes, for delivery to site.
B. Fabricate components with joints tightly fitted and secured.
C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
E. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
F. Accurately form components to suit stairs and landings, to each other and to building structure.
G. Ends of railings must radius back towards wall per Code.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
A. Verify blocking behind wall is in place prior to installation.

A.03 INSTALLATION
A. Install components plumb and level, accurately fitted, free from distortion or defects.
B. Provide anchors, plates angles required for connecting railings to structure. Anchor railing to structure.
C. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 ERECTION TOLERANCES
A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset from True Alignment: 1/4 inch.

END OF SECTION 05520

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Framing with dimension lumber.
   2. Framing with engineered wood products.
   3. Wood blocking, cants, and nailers.
   4. Wood furring.
   5. Subflooring and underlayment.
   6. Plywood backing panels.
   7. Building wrap.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

C. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. 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 lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
   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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   4. Provide dressed lumber, S4S, unless otherwise indicated.
   5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
   6. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Wood Structural Panels:
   1. Plywood: DOC PS 1.
   2. Oriented Strand Board: DOC PS 2.
   3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
   4. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
   5. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 lumber except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
      a. Chromated copper arsenate (CCA).
      b. Ammoniacal copper zinc arsenate (ACZA).
      c. Ammoniacal, or amine, copper quat (ACQ).
      d. Copper bis (dimethyldithiocarbamate) (CDDC).
      e. Ammoniacal copper citrate (CC).
      f. Copper azole, Type A (CBA-A).
      g. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
   2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

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, stripping, and similar concealed members in contact with masonry or concrete.
   3. Wood framing members less than 18 inches above grade.
   4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 lumber and AWPA C27 plywood. Identify fire-retardant- treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood
   2. Use treatment that does not promote corrosion of metal fasteners.
   3. Use Exterior type for exterior locations and where indicated.
   4. Use Interior Type A High Temperature (HT), unless otherwise indicated.

B. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.4 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 2 grade.

C. Exterior and Load-Bearing Walls Construction or No. 2 grade. **Reference Structural Drawings for additional information.**
D. Ceiling Joists (Non-Load-Bearing): Construction or No. 2 grade. **Reference Structural Drawings for additional information.**
E. Joists, Rafters, and Other Framing Not Listed Above: Construction or No. 1 grade. **Reference Structural Drawings for additional information.**

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
1. Rooftop equipment bases and support curbs.
2. Blocking.
3. Cants.
4. Nailers.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent maximum moisture content.
C. For exposed boards, provide lumber with 15 percent maximum moisture content.
D. For concealed boards, provide lumber with 15 percent maximum moisture content.
E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 ENGINEERED WOOD PRODUCTS

A. Veneer Lumber: A composite of wood veneers with grain primarily parallel to member lengths, manufactured with an exterior-type adhesive complying with ASTM D 2559.
B. Parallel-Strand Lumber: A composite of wood strand elements with grain primarily parallel to member lengths, manufactured with an exterior-type adhesive complying with ASTM D 2559.
C. Wood I-Joists: Prefabricated units complying with APA PRI-400; depths and performance ratings not less than those indicated.
D. Rim Boards: Performance-rated product complying with APA PRR-401.

2.7 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire- retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
B. Nails, Brads, and Staples: ASTM F 1667.
C. Power-Driven Fasteners: CABO NER-272.
D. Wood Screws: ASME B18.6.1.
E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
F. Lag Bolts: ASME B18.2.1.
G. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.
H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in

concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.9 METAL FRAMING ANCHORS

A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
   1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
   2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.
   1. Use for exterior locations and where indicated.

D. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.
   1. Thickness: 0.050 inch.

E. I-Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
   1. Thickness: 0.050 inch.

F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
   1. Strap Width: 1-1/2 inches.
   2. Thickness: 0.050 inch.

G. Bridging: Rigid, V-section, nailless type, 0.062 inch thick, length to suit joist size and spacing.

H. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch- minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.

I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
   1. Width: 3/4 inch.
   2. Thickness: 0.050 inch.
   3. Length: 16 inches.

J. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.

K. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

L. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.

M. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

N. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.

O. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.10 MISCELLANEOUS MATERIALS

A. Vapor Barrier over Wall Sheathing: Asphalt-saturated organic felt complying with ASTM D 226, Type I (No. 30 asphalt felt), unperforated.

B. Vapor Barrier over Roof Sheathing: Tamko, TW Metal and Tile Underlayment. Self-Adhered.

C. Building Wrap Tape: Pressure-sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap.

D. Sheathing Tape: Pressure-sensitive plastic tape for sealing joints and penetrations in sheathing and recommended by sheathing manufacturer for use with type of sheathing required.

E. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1- inch nominal thickness, compressible to 1/32 inch ; selected from manufacturer's standard widths to suit width of sill members indicated.

F. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

G. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

H. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2- propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
4. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.
5. Table 2306.1, "Fastening Schedule," in the Standard Building Code.
6. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in the International One- and Two-Family Dwelling Code.

E. 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 between members. Install fasteners without splitting wood; predrill as required.

F. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or 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. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FRAMING INSTALLATION, GENERAL

A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Do not splice structural members between supports.

D. Where built-up beams or girders of 2-inch nominal- dimension lumber on edge are required, fasten together with 2 rows of 20d nails spaced not less than 32 inches o.c. Locate one row near top edge and other near bottom edge.

3.4 WALL AND PARTITION FRAMING INSTALLATION

A. General: Arrange studs so wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load- bearing partitions. Anchor or nail plates to supporting construction, unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches o.c., unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-4-inch nominal-size wood studs spaced 16 inches o.c., unless otherwise indicated.

B. Construct corners and intersections with three or more studs. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

C. Fire block concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where fire blocking is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal- thick lumber of same width as framing members.

D. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs with headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
2. For load-bearing walls, provide double-jamb studs for openings 72 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

E. Provide bracing in exterior walls, at both walls of each external corner, full-story height, unless otherwise indicated. Provide one of the following:

F. Provide bracing in walls, at locations indicated, full-story height, unless otherwise indicated. Provide one of the following:

1. Diagonal bracing at 45-degree angle using let-in 1-by-4-inch nominal- size boards.
2. Diagonal bracing at 45-degree angle using metal bracing.
3. Plywood panels not less than 48 by 96 inches applied vertically.
4. Oriented-strand-board panels not less than 48 by 96 inches applied vertically.
5. Particleboard sheathing panels not less than 48 by 96 inches applied vertically.
6. In lieu of bracing at corners or at locations indicated, continuous gypsum sheathing may be provided in panels not less than 48 by 96 inches applied vertically.
7. In lieu of bracing at corners or at locations indicated, continuous fiberboard sheathing, intermediate type, may be provided in panels not less than 48 by 96 inches applied vertically.

3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION

A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
   1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4- inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
   1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
   2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.

3.6 VAPOR BARRIER AT ROOF APPLICATION

A. Apply building paper horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails. Cover upstanding flashing with 4-inch overlap.

3.7 VAPOR BARRIER AT WALL APPLICATION

A. Cover wall sheathing with building wrap as indicated.
   1. Comply with manufacturer's written instructions.
   2. Cover upstanding flashing with 4-inch overlap.
   3. Seal seams, edges, and penetrations with tape.
   4. Extend into jambs of openings and seal corners with tape.

END OF SECTION 06100

SECTION 06114

WOOD BLOCKING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, wall mounted tv/monitors and wood trim.
- B. Wood furring and grounds.

PART 2 PRODUCTS

2.01 MATERIALS
- A. Miscellaneous Blocking: Minimum stud grade
- B. Plywood: APA Rated Sheathing, Grade C-D; Exposure Durability 1; sanded
- C. Roof Curbs and Cants: Treated lumber.

2.02 ACCESSORIES
- A. Fasteners and Anchors:
  1. Fasteners: Hot-dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
  2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

PART 3 EXECUTION

3.01 FRAMING
- A. Set members level and plumb, in correct position.
- B. Place horizontal members flat, crown side up.
- C. Construct curb members of single pieces.
- D. Space framing and furring 16 inches o.c.
- E. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- F. Coordinate curb installation with installation of decking and support of deck openings, roofing vapor retardant, and parapet construction.

3.02 SCHEDULES
- A. Concealed Blocking: Provide fire resistant wood blocking within all cavity wall (wood stud framing) construction for attachment of all wall mounted work.
- B. Where allowed, (reference stud wall construction) provide adequate blocking in stud walls of all group toilets to allow through – bolting of all wall mounted toilet accessories and toilet partitions. Attach blocking to the wall framing with bolt or lag screw only. Nailing not acceptable.
- C. Provide CCA-treated wood at exterior locations, when used in association with the roofing system or when in contract with concrete or masonry.

END OF SECTION 06114

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Finish carpentry items, other than shop prefabricated casework.
- B. Hardware and attachment accessories.

1.02 QUALITY ASSURANCE
- A. Perform work in accordance with AWI Custom.

1.03 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site under provisions of the General Requirements.
- B. Protect work from moisture damage.

1.04 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

1.05 COORDINATION
- A. Coordinate the work with plumbing and electrical rough-in, and installation of associated and adjacent components.

PART 2 PRODUCTS

2.01 SHEET MATERIALS
- A. Wood Particleboard: ANSI A208.1 Type 1; AWI standard, composed of wood chips, medium density, made with high waterproof resin binders; of grade to suit application; sanded faces. 1" thick with full thickness plastic laminate over all four faces and ends. 3/4" thick with full thickness plastic laminate over all exposed faces.
- B Plywood Veneer: 7/16" thick Birch veneer plywood. B/BB grade.

2.02 FASTENERS
- A. Fasteners: Of size and type to suit application; Galvanized finish in concealed locations and Brass or Chrome finish in exposed locations.

2.03 FABRICATION
- A. Fabricate to AWI Custom standards.
- B. Shop assemble work for delivery to site, permitting passage through building openings.
- C. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
- D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.04 SHOP FINISHING
- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.
- D. Seal, stain, and varnish exposed to view surfaces. Brush apply only.
- E. Prime paint. Seal surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install work in accordance with AWI Custom Quality Standard.
B. Set and secure materials and components in place, plumb, and level.
C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
D. Install components trim with nails, screws, bolts with blind fasteners or wall adhesive by gun application.
E. Install hardware in accordance with manufacturer's instructions.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.
B. Brush apply two coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings. Treat site-sawn cuts.
C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Site Finishing: Refer to Section 09900.
B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 SCHEDULE

A. Interior:
   1. **Coat Shelves shall have full thickness plastic laminate over all exposed surfaces of 1" particle board. Vertical supports shall have full thickness plastic laminate over all exposed surfaces of 3/4" particle board. Provide 1 1/4" diameter chrome rods similar to Knape & Vogt, 770 5 Series.**
      a. **Base Bid: (1) 16'-4"+- long shelf and (1) 6'-0" long shelf.**
      b. **Alternate #1: (1) 8'-9"+- long shelf and (1) 6'-0" long shelf.**
   2. **Wall Wainscot and Fake Columns shall be 7/16" thick Birch veneer plywood. B/BB grade. Paint exposed faces.**

END OF SECTION 06200

SECTION 06410

CUSTOM CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Countertops, base and wall cabinets.
- B. Cabinet hardware.
- C. Prefinished surfaces.
- D. Preparation for installing utilities.

1.02 SUBMITTALS
- A. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes.

1.03 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years' documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store and handle products to site.
- B. Protect units from moisture damage.

1.05 FIELD MEASUREMENTS
- A. Verify that field measurements are as on shop drawings.

1.06 COORDINATION
- A. Coordinate the work with plumbing and electrical rough-in.

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A. Salina Planing Mill (Salina)
- B. Cabinetry & Millwork Concepts (Topeka)
- C. Wend-Wood (Wichita)
- D. Kitchens Inc. (Dodge City)
- E. Substitutions: Under provisions of the General Requirements.

2.02 WOOD MATERIALS
- A. Hardwood Lumber: FAS and F1F by NHLA; Graded in accordance with AWI Premium Grade; average moisture content of 6 percent; species and cut to match existing.

2.03 SHEET MATERIALS
- A. Hardwood Plywood: S 51; graded in accordance with AWI, core materials of veneer, and lumber, type of glue recommended for application; face veneer and cuts as follows:

ITEM	FACE SPECIES
Drawer 'Box' Construction	Melamine (unless noted otherwise) - Per AWI Premium Grade.
Door Construction	Plastic Laminate (u.n.o.) - Per AWI Premium Grade.
Cabinet 'Body' Construction	Plastic Laminate at exposed (u.n.o.). Melamine at unexposed (u.n.o.) - Per AWI Premium Grade.
Backs	Plastic Laminate at exposed (u.n.o.). Melamine at unexposed (u.n.o.) - Per AWI Premium Grade.
Shelving	Melamine (u.n.o.) - Per AWI Premium Grade.

(Note: Melamine color to be White.)

B. High Performance particleboard Core:
   1. Particleboard to be ¾" thick of 45 lb. Density, and balanced construction with moisture Content not to exceed 8%. All particleboards shall meet or exceed the requirements for its type and classification under Commercial Standard CS-236-66, Federal Specifications LLL-B-800A, and ASTM D 1037-78.
   2. Particleboard shall meet the following performance requirements. Submit compliance data from the manufacturer prior to fabrication:

Screw Holding, Face	471 lbs.
Modulus of Rupture	2,400 psi.
Modulus of Elasticity	450,000 psi.
Internal Bond	90 psi.
Surface Hardness	900 lbs.

C. Hardboard: Hardboard shall meet or exceed Commercial Standards CS-251 and Federal Specifications LLL-B-00810. Tempered hardboard ¼" thick, smooth both sides.

2.04 MANUFACTURERS - PLASTIC LAMINATE

A. Plastic Laminate Surfaces: Wilsonart Premium Laminate

B. Colors: Owner to select from full line for countertops and backsplashes.

C. Reference Drawings for locations of plastic laminate

2.05 LAMINATE MATERIALS

A. Plastic Laminate: AWI, 0.048 inch General Purpose quality V32 grade; color, pattern, and surface texture as selected from "premium" color range, shall meet NEMA standards for vertical grade.

B. Laminate Backing Sheet: 0.020 inch Backing Sheet grade, undecorated plastic laminate shall meet NEMA standards and be of a type and thickness to properly balance face finish.

2.06 ACCESSORIES

A. Adhesive: FS MMM-A-130 contact adhesive, type recommended by AWI and laminate manufacturer to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; approved finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

2.07 HARDWARE

A. Hinges: Blum #71B3580 Clip Top BluMotion; 110° operation; Quiet close type.

B. Pulls: Hafele, 116.07.318 Wire Pull, Essentials, Steel, (3-1/2"). Finish/color selected from manufacturer's full line.

C. Drawer Slides: Tandum Plus BluMotion #563; Supplier verify maximum length allowable at cabinet.

D. Adjustable Shelf Clips: Hafele 282.12.405.

E. Cushion Bumpers: Hafele #356.21.428 – clear. Two on each door & drawer.

2.08 FINISHING MATERIALS

A. Stain, Varnish and Finishing Materials: As specified in Section 09900.

2.09 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

B. Fit shelves, doors, and exposed edges with 3 mm PVC, color matched to cabinet body. Use one piece for full length only. No edge tape allowed.

C. Cap exposed plastic laminate finish edges with material of same finish and pattern.

D. Door and Drawer Fronts: 3/4 inch thick; overlay style.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arrises. Locate counter butt joints minimum 2 feet from sink cut-outs.

G. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

H. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.

2.10 FINISHING
A. Sand work smooth and set exposed nails and screws.
B. Apply wood filler in exposed nail and screw indentations.
C. On items to receive transparent finishes, use wood filler, which matches surrounding surfaces and of types recommended for applied finishes.
D. Seal, stain and varnish exposed to view surfaces.
E. Seal, stain and varnish internal exposed to view and semi-concealed surfaces.
F. Seal surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify adequacy of backing and support framing.

3.02 INSTALLATION
A. Set and secure casework in place; rigid, plumb, and level.
B. Use fixture attachments in concealed locations for wall mounted components.
C. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.
D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
E. Secure cabinet and counter bases to floor using appropriate angles and anchorages.
F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING
A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING
A. Clean casework, counters, shelves, hardware, fittings and fixtures.

3.05 SCHEDULE
A. Adjustable shelving longer than 34” to be 1” thick.

END OF SECTION 06410

SECTION 07110

SHEET MEMBRANE WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. **Adhesive applied elastomeric sheet membrane waterproofing at Alternate Bid #1 Elevator Shaft Foundation Wall.**
B. Cant strips.

1.02 REFERENCES
A. ASTM D412 - Rubber Properties in Tension.
B. ASTM D624 - Rubber Property - Tear Resistance.
C. ANSI/ASTM D746 - Brittleness Temperature of Plastics and Elastomers by Impact.
D. ASTM E96 - Water Vapor Transmission of Materials.

1.03 SYSTEM DESCRIPTION
A. Waterproofing System: Capable of resisting water head of 15 feet and preventing moisture migration to interior.

1.04 SUBMITTALS
A. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
B. Product Data: Provide data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.
C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALIFICATIONS
A. Membrane Manufacturer: Company specializing in waterproofing sheet membranes with three years experience.
B. Applicator: Company specializing in performing the work of this Section with minimum two years documented experience and approved by manufacturer.

1.06 ENVIRONMENTAL REQUIREMENTS
A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured or as required by the manufacturer.

1.07 WARRANTY
A. Provide three year warranty under provisions of the General Requirements.
B. Warranty: Include coverage for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change of shrinkage is not considered a structural failure.
C. For warranty repair work, be responsible for removing and replacing materials concealing waterproofing.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Grace.
B. Substitutions: Under provisions of the General Requirements.

2.02 MEMBRANE MATERIALS
A. Membrane: MEL ROL 56 mils thick; polymeric membrane by Grace, non-asphaltic.

2.03 ADHESIVE MATERIALS
A. As recommended by manufacturer, compatible with sheet membrane.
B. Elastomeric Mastic: 200 lin. ft. per gal.
C. Liquid Membrane: 135 lin. ft. per gal.

D. Thinner and Cleaner: As recommended by manufacturer, compatible with sheet membrane.

2.04 ATTACHMENT MATERIALS
A. Battens, Disc Washers and Screws, Circular Membrane Discs, and Reglet Strip Devices: All as recommended by the manufacturer.

2.05 ACCESSORIES
A. Protection Board: As recommended by membrane manufacturer.
B. Sealant: As recommended by membrane manufacturer.
C. Cant Strips and Flexible Flashings: As recommended by manufacturer.
D. Counter Flashings: As recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
B. Verify items which penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION
A. Protect adjacent surfaces not designated to receive waterproofing.
B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
C. Do not apply waterproofing to surfaces unacceptable to manufacturer or applicator.
D. Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer.
E. Apply surface conditioner at a rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

3.03 INSTALLATION - ADHESIVE BONDED
A. Install membrane waterproofing in accordance with manufacturer's instructions.
B. Roll out membrane. Minimize wrinkles and bubbles.
C. Apply adhesive in accordance with manufacturer's instructions. Bond sheet to substrate.
D. Lap sides and ends in accordance with membrane manufacturer's instructions.
E. Overlap edges and ends and seal with contact adhesive minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
F. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or moving.
G. Weatherlap joints on sloped substrate in direction of drainage. Seal joints and seams. Coordinate with drain installation.
H. Install flexible flashings. Seal watertight to membrane.
I. Seal membrane and flashings to adjoining surfaces.
J. Extend membrane up cant strips and minimum of 6 inches onto vertical surfaces.
K. Seal items penetrating membrane and install counter flashing membrane material.

3.04 PROTECTION OF FINISHED WORK
A. Protect finished Work.
B. Do not permit traffic over unprotected or uncovered membrane.
C. **Protect membrane from damage by adhering protection board, applied with mastic over membrane surface. Scribe and cut boards around projections and interruptions.**

END OF SECTION 07110

SECTION 07181

WATER REPELLENT COATING

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. Water repellent coating applied to exterior exposed brick and masonry unit walls.

1.02 SYSTEM DESCRIPTION
A. Applied coating to repel moisture absorption in material being treated.

1.03 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle products to site.
B. Protect coating liquid from freezing.

1.04 ENVIRONMENTAL REQUIREMENTS
A. Do not apply coating when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. HYDROZO - Clear Double 7.
B. ProSoCo Sure Klean Weather Seal.
C. Substitutions: Under provisions of the General Requirements.

2.02 MATERIALS
A. Coating: Silane; containing 12 percent minimum solids.

PART 3 – EXECUTION

3.01 EXAMINATION
A. Verify joint sealants are installed and cured.
B. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of coating.

3.02 PREPARATION
A. Delay work until masonry mortar concrete substrate is cured a minimum of 5 days.
B. Remove loose particles and foreign matter.
C. Remove oil or foreign substance with a chemical solvent which will not affect coating.
D. Scrub and rinse surfaces with water and let dry.

3.03 APPLICATION
A. Apply coating in accordance with manufacturer's instructions.
B. Apply at a rate of 80 sq. ft. per gallon by airless spray.
C. Apply in one continuous, uniform coat.

END OF SECTION 07181

SECTION 07191

DAMPPROOFING AND WATERPROOFING

1.01 WATERPROOF MEMBRANE AT FLOOR SLABS

A. Furnish and install 15 mil. Visqueen under interior concrete slabs on grade. Lap and seal all seams; patch any punctures with a 6-inch minimum overlap.

END OF SECTION 07191

SECTION 07213

BATT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Batt insulation for filling perimeter window and door shim spaces, crevices in exterior wall and roof.
- B. Sound batt insulation.
- C. Vapor retarder.

1.02 REFERENCES
- A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- B. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E136

1.03 SYSTEM DESCRIPTION
- A. Materials of This Section: Provide continuity of thermal barrier at building enclosure in conjunction with thermal insulating materials in Section 07212. Overlap insulations to ensure complete thermal envelope at all exterior surfaces.

1.04 COORDINATION
- A. Coordinate the work with all related Sections for installation of vapor retarder and other forms of insulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS - INSULATION MATERIALS
- A. OWENS-CORNING FIBERGLASS Product - thermal batt insulation.
  1. Sound Attenuation batt insulation.
  2. Flame Spread 25, smoke developed 50, Fiberglass insulation and Facing
  3. Perm rating of .02.
- B. Substitutions: Under provisions of the General Requirements.

2.02 MATERIALS
- A. Batt Insulation Between Second Floor Wood Floor Joists: ASTM C665; preformed glass fiber batts; secured to floor joists, conforming to the following:
  1. Batt Size and Facing: 12” FSK (foil) at walls.
- B. Sound Batt Insulation:
  1. Batt size: 3 1/2” and 6” – coordinate with wall thickness.
  2. Facing: Unfaced.
- C. Tape: Self-adhering type as recommended by the manufacturer, mesh reinforced, 2 inches wide.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify site conditions.
- B. Verify that substrate, adjacent materials, and insulation are dry and ready to be installed.

3.02 INSTALLATION
- A. Install insulation and vapor retarder in accordance with manufacturer’s instructions.
- B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.
- D. Install with applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane, caulk, or tape.
- E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

END OF SECTION 07213

SECTION 07611

PRE-MANUFACTURED SHEET METAL

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Metal Roofing, associated integral flashings, and underlayment.
- B. Flashings, Trim, and Counterflashings per manufacturer.
- C. Metal Soffit
- D. Metal Fascia

1.02 SYSTEM DESCRIPTION
- A. Roofing (Main Entry Canopy): Pre-coated standing seam metal roof, over self-adhesive membrane over ½" plywood over existing roof.
- B. Soffit (Main Entry Canopy): Pre-coated metal panels over existing.
- D. Fascia (Main Entry Canopy): Pre-coated metal over existing.

1.03 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE
- A. Perform work in accordance with Manufacturer's specifications, recommendations and if not indicated SMACNA standard details and requirements.

1.05 QUALIFICATIONS
- A. Fabricator and Installer: Company specializing in sheet metal roof installations with minimum 5 years' documented experience.

1.06 REGULATORY REQUIREMENTS
- A. Conform to applicable code for Roof Assembly Fire Requirements.
- B. UL: Class C Fire Hazard Classification, UL 90 uplift.

1.07 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to prevent damage to material or finish.
- B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.

1.08 COORDINATION
- A. Coordinate the work with installing associated metal flashings, trims, gutters, downspouts, etc., as the work of this section progresses.

1.09 WARRANTY
- A. Provide roofers two year warranty covering materials (including insulation, flashings, trim, gutters, downspouts,) and workmanship.
- B. Provide manufacturer's 20-year warranty covering materials (including insulation, flashings, trim, gutters, and downspouts), and workmanship for weather tightness.

PART 2 PRODUCTS

2.01 METAL ROOF PANEL MANUFACTURERS
- A. MBCI, BattenLok, 16-inch wide with 2" ribs. **Color: True Black.**
- B. McElroy Metal, 238T Symmetrical Panel, 16-inch wide with 2" ribs. 24 ga. **Color (Kynar 500) Matte Black.**
- C. Substitutions: Under provisions of the General Requirements, or as approved by Architect.

2.02 METAL SOFFIT MANUFACTURERS

A. MBCI Artisan Series, L12 w/ recessed beads at 4" o.c., 12" wide, lightly textured finish. **Color: True Black.** Provide support as recommended by manufacturer to avoid sagging.

B. Substitutions: Under provisions of the General Requirements, or as approved by Architect.

2.03 METAL FASCIA

A. Pre-Coated Galvanized Steel: ASTM A446, Grade A, G90 zinc coating; 24 gage core steel with beads at 4"o.c. horizontally, shop pre-coated with KYNAR 500 coating. **Color: True Black.**

2.04 SHEET MATERIALS

A. Pre-Coated Galvanized Steel: ASTM A446, Grade A, G90 zinc coating; 24 gage core steel, shop pre-coated with KYNAR 500 coating. **Color: True Black.**

2.05 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers, per manufacturer's recommendations.

B. **Underlayment: Tamko, TW Metal and Tile Underlayment.**

C. Slip Sheet: Rosin sized building paper.

D. Primer: Zinc chromate type.

E. Protective Backing Paint: Zinc chromate alkyd.

F. Sealant: Polyurethane type, manufactured by Bostic.

G. Bedding Compound: Rubber-asphalt type.

H. Plastic Cement: ASTM D4586, Type I.

I. **Eave (Ice Dam) Protection: Tamko, TW Metal and Tile Underlayment.**

J. Solder: ASTM B32; 50/50 type.

K. Flux: FS O-F-506.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify and coordinate site conditions which satisfy manufacturer's requirements.

3.02 ROOF PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.03 ROOF INSTALLATION - EAVE (ICE DAM) PROTECTION

A. Place eave edge metal flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced 12 inches oc.

B. Apply rubberized asphalt/polyethylene sheet eave protection in accordance with manufacturer's instructions.

C. Apply lap cement at rate of approximately 1 1/4 gal/100 sq ft over underlayment starter strip.

D. Starting from lower edge of starter strip, lay additional 36 inch wide strips of underlayment in lap cement, to produce a two ply membrane. Weather lap plies minimum 19 inches and nail in place. Lap ends minimum 6 inches. Stagger end joints of each consecutive ply.

E. Extend eave protection membrane minimum 4 feet upslope beyond interior face of exterior wall.

3.04 ROOF INSTALLATION

A. Conform to drawing details as provided and recommended by manufacturer.

B. Apply underlayment in single layer laid perpendicular to slope; weather lap edges 2 inches and nail in place. Minimize nail quantity.

C. Apply slip sheet in one layer, laid loose.

D. Cleat and seam all joints.

E. Use bedding compound for joints between metal and bitumen or metal and felts.

F. Stagger transverse joints of roofing sheets.

G. Provide integral gutters, downspouts, fascias, and metal splash pans as required.

H. Back paint surfaces in contact with dissimilar materials.

3.05 STANDING SEAM ROOFING

A. Conform to manufacturer's details, recommendations, and specifications.
B. Space standing seams at 16 inches oc.
C. Lay sheets with long dimension perpendicular to eaves. Apply pans beginning at eaves.
D. Lock cleats into seams and flatten.
F. Terminate standing seams at ridge, eaves, and hips per manufacturer's details and recommendations.

3.06 ERECTION – WALL AND FASCIA SYSTEMS

A. Install in accordance with manufacturer's instructions.
B. Exercise care when cutting pre-finished material to ensure cuttings do not remain on finish surface.
C. Fasten cladding system to structural supports, aligned level and plumb.
D. Locate end laps over supports. End laps minimum 2 inches. Place sidelaps over bearing.
E. Provide expansion joints where indicated.
F. Install sealant and gaskets to prevent weather penetration.
G. System: Free of rattles, noise due to thermal movement and wind whistles.

3.07 GUTTERS and FLASHINGS

A. Refer to Section 07620.

3.08 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of the General Requirements.
B. Do not permit traffic over unprotected roof surface.

END OF SECTION 07611

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Cap and sill flashings.
- B. Counterflashings at roof mounted equipment and vent stacks.
- C. Miscellaneous flashings and closure pieces.

1.02 SUBMITTALS
- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.03 QUALITY ASSURANCE
- A. Perform work in accordance with SMACNA standard details and requirements.

1.04 QUALIFICATIONS
- A. Fabricator and Installer: Company specializing in sheet metal flashing work with three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site under provisions of the General Requirements.
- B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS
- A. Fascia Material: 24 gage, pre-coated galvanized steel with beads at 4”o.c. horizontally with lightly textured finish. KYNAR. **Color: True Black**.
- B. Soffit Material: 24 gage, pre-coated galvanized steel similar to MBCI Artisan Series L12 with recessed beads at 4” o.c., 12” wide, lightly textured finish. KYNAR. **Color: True Black.** Provide support as recommended by manufacturer to avoid sagging.

2.02 ACCESSORIES
- A. Fasteners: Galvanized steel with soft neoprene washers.
- B. Underlayment: ASTM D2178, No. 15 asphalt saturated roofing felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Zinc chromate type.
- E. Sealant: Polyurethane type, specified in Section 07900.
- F. Bedding Compound: Rubber-asphalt type.
- G. Plastic Cement: ASTM D4586, Type II.
- H. Reglets: Recessed type, galvanized steel; face and ends covered with plastic tape.

2.03 FABRICATION
- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of metal, same material as sheet, interlockable with sheet.
- C. Form pieces in longest possible lengths. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam and/or solder for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- G. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.

2.04 FINISH
- A. Exposed metal shall be pre-finished with Kynar finish color to be selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.03 INSTALLATION

A. Conform to drawing details included in the SMACNA manual unless otherwise indicated on the drawings.

B. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

END OF SECTION 07620

SECTION 07631

GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Precoated galvanized or aluminum steel gutters and downspouts.

1.02 RELATED SECTIONS
- A. Section 07620 - Sheet Metal Flashing and Trim.

1.03 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site under provisions of the General Requirements.
- B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MATERIALS
- A. Pre-Coated galvanized Steel: ASTM A361, G90 zinc coating; 24 gage, core steel, shop precoated with coating of color as selected.
- B. Pre-coated Aluminum: Kynar or baked enamel finish of .032".

2.02 COMPONENTS
- A. Gutters: 10"wide x 28"long x 10"deep (occurs on north side of building) of configuration to closely match existing. **Color: True Black.**
- B. Downspouts: 8x8 (occurs on north side of building). **Color: True Black.**

2.03 ACCESSORIES
- A. Anchorage Devices: Type recommended by fabricator.
- B. Gutter Supports: Brackets and straps.
- C. Downspout Supports: Brackets and straps.
- D. Fasteners: Galvanized steel, finish to match gutters and downspouts
- E. Protective Backing Paint: Zinc chromate alkyd.

2.04 FABRICATION
- A. Form gutters and downspouts of profiles indicated.
- B. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- C. Hem exposed edges of metal.
- D. Fabricate gutter and downspout accessories; seal watertight.

2.05 FINISHES
- A. Apply bituminous protective backing on surfaces in contact with dissimilar materials.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify that surfaces are ready to receive work.

3.02 INSTALLATION
- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Join lengths with seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Slope gutters 1 inch per 24 feet.
- D. Seal metal joints watertight.

END OF SECTION 07631

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Preparing substrate surfaces.
- B. Sealant and joint backing.

1.02 QUALITY ASSURANCE
- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform acoustical sealant application work in accordance with ASTM C919.

1.03 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum years documented experience.

1.05 WARRANTY
- A. Provide five year warranty.
- B. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS
- A. Exterior vertical joints shall be filled with a one-part nonacid-curing silicone sealant. Sealant shall be Type S, Grade NS, Class 25, and providing 35% movement in both extension and compression for a total of 70% movement.
  1. Acceptable products are as follows:
     a. "Chem-Calk Ncure 2000"; Bostik Construction Products Div.
     b. "Dow Corning 790"; Dow Corning Corp.
     c. "Silglaze N SCS 2501"; General Electric Co.
     d. "Silpruf SCS 2000"; General Electric Co.
     e. "864"; Pecora Corp.
     f. "Rhodorsil 5C"; Rhone-Poulenc Inc.
     g. "Spectrum 1"; Tremco, Inc.
- B. Interior joints in toilet rooms, showers, janitor closets, and other similar locations shall be sealed with a one-part, mildew-resistant, silicone sealant. Sealant shall be type S, Grade NS, class 25 formulated with fungicide and intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.
  1. Acceptable products are as follows:
     a. "Dow Corning 786"; Dow Corning Corp.
     b. "SCS 1702 Sanitary"; General Electric Co.
     c. "863 #345 White"; Pecora Corp.
     d. "Rhodorsil 6B White"; Rhone-Poulenc Inc.
     e. "Proglaze White"; Tremco Corp.
     f. "OmniPlus"; Sonneborn Building Products Div.
- C. Interior joints in locations other than those otherwise specified, including at where new and existing windows meet other materials, shall be sealed with manufacturer's standard, one part, nonsag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior and on protect exterior locations involving joint movement of not more than plus or minus 5%.
  1. Acceptable products are as follows:
     a. "Chem-Calk 600"; Bostik Construction Products Div.
     b. "AC-20"; Pecora Corp.
     c. "Sonolac"; Sonneborn Building Products Div.; Rexnord Chem.

D. At all sealant locations in fire rated assemblies provide manufacturer's standard fire-stopping sealant, with accessory materials, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Acceptable products are as follows:
      a. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
      b. "Pensil 851"; General Electric Co.
      c. "Fire Barrier CP-25 & 303"; 3M.

2.02 ACCESSORIES
A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
C. Joint Backing: ASTM D1056; round, closed or open cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that substrate surfaces and joint openings are ready to receive work.
B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION
A. Remove loose materials and foreign matter which might impair adhesion of sealant.
B. Clean and prime joints in accordance with manufacturer’s instructions.
C. Perform preparation in accordance with manufacturer’s instructions.
D. Protect elements surrounding the work of this section from damage or disfiguration.

3.03 INSTALLATION
A. Install sealant in accordance with manufacturer’s instructions.
B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.
C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
D. Install bond breaker where joint backing is not used.
E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.04 SCHEDULE
A. Interior: Caulk around all frames, windows, doors, openings, trim, etc., as required to seal or fill gaps, cracks, to make material transitions watertight and/or visually tight and finished.
B. Exterior: Caulk around all paving and sidewalk joints, exterior masonry joints, frames, windows, doors, openings, trim, material transitions etc., as required to seal or fill gaps, cracks, to make material transitions watertight and/or visually tight finished.

END OF SECTION 07900

SECTION 08111

STANDARD STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Non-rated, fire rated and thermally insulated steel doors and frames.

1.02 REFERENCES
- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/SDI-100 - Standard Steel Doors and Frames.
- C. Door Hardware Institute (DHI) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- D. NFPA 80 - Fire Doors and Windows.
- E. NFPA 252 - Fire Tests for Door Assemblies.
- F. UL 10B - Fire Tests of Door Assemblies.
- G. ANSI A151.1 – 1,000,000 cycle slam test for extra heavy duty doors and frames.

1.03 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Shop Drawings: Indicate door and frame elevations, internal reinforcement, closure method, and cut-outs for glazing and finish.
- C. Product Data: Indicate door and frame configurations, anchor types and spacings, location of cut-outs for hardware reinforcement.
- D. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.04 REGULATORY REQUIREMENTS
- A. Fire Rated Door and Frame Construction: Conform to ASTM E152 and NFPA 252.
- B. Installed Door and Panel Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site.
- B. Accept doors and frames on site in manufacturer's packaging. Inspect for damage.

1.06 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.01 DOOR MANUFACTURERS (**FOR EXTERIOR & BASEMENT**)
- A. Atlantic Metal Products, Inc.
- B. Overly Manufacturing Co.
- C. Williamsburg Steel Products.
- D. Curries Co.
- E. Substitutions: Under provisions of the General Requirements.

2.02 DOORS (**FOR EXTERIOR & BASEMENT**)
- A. Exterior Insulated Doors Non-thermally Broken: SDI-100 Grade III.
- B. Interior Doors (Non-rated and Fire Rated): SDI-100 Grade III.

2.03 DOOR CONSTRUCTION
- A. Face: Steel sheet in accordance with ANSI/SDI-100. Galvanized at exterior locations.
- B. Core: Polystyrene foam.
- C. Thermal Insulated Door: Total insulation R value of 7.7, measured in accordance with ASTM C236.

2.04 FRAME MANUFACTURERS
- A. Exterior Frames and Basement: Atlantic, Overly, Willamsburg, Curries.
- B. Interior Frames: Timely (by Trudoor).

2.05 FRAMES
- A. Exterior Frames: 16 gage thick material, base metal thickness.
- B. Interior Frames: 16 gage thick material, base metal thickness.

2.06 ACCESSORIES
- A. Removable Stops: Rolled steel channel shape, mitered corners; prepared for countersink style screws.
- B. Primer: Zinc chromate type.
- C. Silencers: Resilient rubber, fitted into drilled hole.
- D. Glazing: 1" insulated at exterior doors.

2.07 FABRICATION
- A. Astragals for Double Doors: Steel, T shaped, specifically for double doors.
- B. Fabricate doors with hardware reinforcement welded in place.
- C. Attach fire rated label to each door unit.
- D. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.
- E. Configure exterior doors with special profile to receive recessed weatherstripping.
- **F. Fabricate Exterior and Basement Frames as welded unit. Timely Frames to be Knock-Down.**
- G. Mullions for Double Doors: Removable type, of same profiles as jambs.
- H. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.
- I. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- J. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- K. Prepare frame for silencers. Provide three single silencers for single doors and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.
- L. Configure exterior frames with special profile to receive recessed weatherstripping.
- M. Fabricate frames to suit masonry wall coursing with 4 or 2 inch head member.

2.08 FINISH
- A. Steel Sheet: Galvanized to ASTM A525.
- B. Primer: Baked.
- C. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.
- D. Doors and frames to be field painted.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION
- A. Install doors and frames in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate installation of glass and glazing.
- C. Install door louvers, plumb and level.
- D. Coordinate installation of doors and frames with installation of frames and hardware specified in Section 08710.
- E. Coordinate with masonry and wallboard wall construction for anchor placement.
- F. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.03 ERECTION TOLERANCES
- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING
- A. Adjust door for smooth and balanced door movement.

END OF SECTION 08111

SECTION 08211

FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Flush wood doors; flush and flush glazed configuration; fire rated and non-rated, **prefinished**.

1.02 SUBMITTALS
A. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, identify cutouts for glazing, and louvers.
B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics; factory machining criteria, and factory finishing criteria.
C. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.03 QUALITY ASSURANCE
A. Perform work in accordance with AWI Quality Standard Section 1300, Custom Grade.
B. Finish doors in accordance with AWI Quality Standard, grades identified in schedule.

1.04 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.05 REGULATORY REQUIREMENTS
A. Fire Door Construction: Conform to NFPA 252, UL 10B.
B. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle products to site.
B. Accept doors on site in manufacturer's packaging. Inspect for damage. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on-site to permit ventilation.

1.07 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated on shop drawings.

1.08 COORDINATION
A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.09 WARRANTY
A. Provide warranty to the following term:
1. Exterior Doors: 5 years.
2. Interior Doors: Life of original installation.
B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Base Bid: VT Industries, Eggers Collection, Ogee Sticking, Raised Membrane Pressed Panel, E101 (2-panel), HDF. Factory Finish: White.
B. Alternate #11 Bid: Trudoor, Timely, Prefinished Solid Core Slab Door. Factory Finish: White.

2.02 DOOR TYPES
A. Base Bid: Panelized Doors. 1-3/4 inches thick; solid core construction, fire rated as indicated.
B. Alternate #11 Bid: Flat Slab Doors. 1-3/4 inches thick; solid core construction, fire rated as indicated.

2.03 DOOR CONSTRUCTION
A. Core (Solid, Non-Rated): AWI Section 1300, Type PC-Particleboard.
B. Core (Solid, Fire Rated): AWI Section 1300, Type FP or FM rating as required or indicated.

2.04 FLUSH DOOR FACING

A. Veneer Facing (Stile and Rail Interior Doors): AWI Custom quality **HDF** uniform grain. Door color/finish shall be: White. **Submit samples for Owner's approval.**

2.05 ACCESSORIES

A. Glazing Stops: Wood, of same species as door facing Wood with metal clips for rated doors, mitered corners; prepared for countersink style screws.

2.06 FABRICATION

A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.
B. Fabricate fire rated doors in accordance with AWI Quality Standards and to UL requirements. Attach fire rating label to door.
C. Astragals for Fire Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.
D. Provide lock blocks at lock edge and top of door for closer hardware reinforcement.
E. Vertical Exposed Edge of Stiles: Of same species as veneer facing. Hardwood for transparent finish.
F. Fit door edge trim to edge of stiles after applying veneer facing.
G. Bond edge banding to cores.
H. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through bolted hardware.
I. Factory pre-fit doors for frame opening dimensions identified on shop drawings.
J. Cut and configure exterior door edge to receive recessed weather-stripping devices. Provide edge clearances in accordance with AWI 1600.

2.07 FINISH

A. Manufacturer's prefinished doors in accordance with AWI Quality Standard Section 1500 to the following finish designations: Prefinished Doors: Submit full line of actual samples for selection.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.
B. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install fire rated and non-rated doors in accordance with AWI Quality Standard, NFPA 80 and to Warnock Hersey requirements.
B. Trim non-rated door width by cutting equally on both jamb edges.
C. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm). Trim fire door height at bottom edge only, in accordance with fire rating requirements.
D. Pilot drill screw and bolt holes. Use threaded through bolts for half surface hinges.
E. Machine cut for hardware. Core for handsets and cylinders.
F. Coordinate installation of glass and glazing.

3.03 INSTALLATION TOLERANCES

A. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taught string, corner to corner, over an imaginary 36 x 84 inch surface area.
B. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taught string, top to bottom, over an imaginary 36 x 84 inch surface area.
C. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taught string, edge to edge, over an imaginary 36 x 84 inch surface area.

3.04 ADJUSTING

A. Adjust door for smooth and balanced door movement.

END OF SECTION 08211

SECTION 08410

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Aluminum doors and frames.
- B. Vision glass and glass.
- C. Door hardware including power operator systems.
- D. Integral air and vapor barrier.
- E. Perimeter sealant.

1.02 SYSTEM DESCRIPTION
- A. Aluminum entrances and storefront system includes tubular aluminum sections with supplementary internal support framing, shop fabricated, factory prefinished, vision glass, related flashings, anchorage, and attachment devices.

1.03 PERFORMANCE REQUIREMENTS
- A. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with codes.
- B. Limit mullion deflection to flexure limit of glass; with full recovery of glazing materials.
- C. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
- D. Limit air leakage through assembly to 0.06 cfm/min/sq. ft. of wall area, measured at a reference differential pressure across assembly of psf as measured in accordance with AAMA 501.
- E. Water Leakage: None, when measured in accordance with AAMA 501 with a test pressure difference of 2.86 lbs/sq. ft.
- F. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
- G. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F over a 12-hour period without causing detrimental affect to system components.
- H. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

1.04 SUBMITTALS
- A. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site.
- B. Protect pre-finished aluminum surfaces. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.06 ENVIRONMENTAL REQUIREMENTS
- A. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.07 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings.

1.08 WARRANTY
- A. Provide three-year warranty.
- B. Warranty: Include coverage for complete system for failure to meet specified requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A. Storefront System
  1. Manko - Product series – 2450 thermally broken, Door series – 150H Heavy Style.
  2. Other acceptable manufacturers offering equivalent Products.
     a. Kawneer.
     b. EFCO.
  3. Substitutions: Under provisions of the General Requirements.

2.02 MATERIALS
- A. Extruded Aluminum: ANSI/ASTM B221; 6063 alloy, T5 temper. Color: **Black.**
- B. Steel Sections: ANSI/ASTM A36; shaped to suit mullion sections.
- C. Fasteners: Galvanized steel.

2.03 COMPONENTS
- A. Frame: 4 1/2 x 2 inch nominal dimension; glazing stops; drainage holes; internal weep drainage system. **Complete with manufacturer's trim, clips, head receptor, and subsill with end dams.**
- B. Doors: 2 inches thick, 5-inch wide top rail, 5-inch wide vertical stiles, 10-inch wide bottom rail; square glazing stops.
- C. Flashings: Aluminum, finish to match mullion sections where exposed.

2.04 SEALED INSULATING GLASS MATERIALS
- A. Insulated Glass Units (Type IG): ASTM E774 and E773; double pane with edge seal; outer pane of 1/4 inch clear tempered float glass with PPG Solarban70 #2 surface (Low-E), ½" air space with 90% Argon gas fill, inner pane of 1/4 inch clear tempered float glass.
  1. IG Performance Requirements:
     a. Light transmittance – 64%
     b. U-value – Summer - .24
     c. Solar heat gain coefficient - .27

2.05 SEALANT MATERIALS
- A. Sealant and Backing Materials: As specified in Section 07900.

2.06 HARDWARE
- A. Weather Stripping, Sill Sweep Strips, **Pemko 2005AT Threshold**, Piano Hinges, Tubular Pull Handles, Panic Device, Closer: Manufacturers' standard type to suit application, all provided by storefront manufacturer / supplier. **All finishes to be Black.**
- B. HANDICAP POWER DOOR OPERATOR
  Norton 6670 Powermatic Series or Equal
  1. One unit shall be mounted at Door #101.
  2. Features shall include
     a. Adjustable door opening speed
     b. Adjustable hold-open time.
     c. Adjustable sweep, latch, and back check.
     d. Meet requirements of ANSI A117.1 and A156.19 for access by handicapped.
     e. Include all switches and sensors for two-way traffic.
     f. Remote control operators (hard wired).
        1) Interior remote controls, recessed wall mounted. Reference plans for location.
        2) Exterior remote control, recessed mounted on exterior wall. Reference plans for location.
  3. Equivalent product by Stanley Magic Door shall be acceptable.
- C. Cylinder locks by hardware supplier.

2.07 FABRICATION
- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to conceal from view.
- E. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.
- F. Reinforce framing members for imposed loads.

2.08 FINISHES
- A. Finish coatings to conform to AAMA 2605 (**powder coat**).
- B. **Exposed Aluminum Surfaces: Black**.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify site opening conditions.
- B. Verify dimensions, tolerances, and method of attachment with other work.
- C. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.02 INSTALLATION
- A. Install wall system in accordance with manufacturer's instructions and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings.
- G. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of mastic and secure.
- J. Install hardware using templates provided.
- K. Install glass in accordance with Section 08800, to glazing method required to achieve performance criteria.
- L. Install perimeter sealant to method required to achieve performance criteria, backing materials, and installation criteria in accordance with Section 07900.

3.03 TOLERANCES
- A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING
- A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING
- A. Remove protective material from prefinished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION OF FINISHED WORK
- A. Protect finished Work from damage.

END OF SECTION 08410

SECTION 085413

FIBERGLASS WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes fiberglass-framed windows.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for fiberglass windows.
B. Shop Drawings: For fiberglass windows.
   1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.
D. Product Schedule: For fiberglass windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.
B. Product Test Reports: For each type of fiberglass window, for tests performed by a qualified testing agency.
C. Field quality-control reports.
D. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating fiberglass windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
B. Installer Qualifications: An installer acceptable to fiberglass window manufacturer for installation of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace fiberglass windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, and air infiltration.
      c. Faulty operation of movable sash and hardware.
      d. Deterioration of materials and finishes beyond normal weathering.
      e. Failure of insulating glass.
   2. Warranty Period:
      a. Window: 10 years from date of Substantial Completion.
      b. Glazing Units, Non-Laminated: 20 years from date of Substantial Completion.
      c. Glazing Units, Laminated: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fiberglass windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class: **CW**.
   2. Minimum Performance Grade: **50**.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of .27

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of **0.21**.

E. Sound Transmission Class (STC): Rated for not less than **31** STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.

F. Outside-Inside Transmission Class (OITC): Rated for not less than **27** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

2.3 FIBERGLASS WINDOWS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Pella Corporation; Pella® Impervia® or a comparable product by one of the following:
   1. Accurate Dorwin.
   2. Alpen High Performance Products.
   3. Inline Fiberglass Ltd.
   4. Milgard Manufacturing, Inc.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Fixed.

C. Frames and Sashes: Pultruded fiberglass complying with AAMA/WDMA/CSA 101/I.S.2/A440 and with exposed exterior fiberglass surfaces finished with manufacturer's standard enamel coating complying with AAMA 624.
   1. Exterior Color: **Black**.
   2. Interior Finish: **Black**.

D. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
   1. Kind: Fully tempered.

E. Insulating-Glass Units: ASTM E2190.
   1. Glass: ASTM C1036, Type 1, Class 1, q3.
      a. Tint: **Clear at Spandrel window units with painted black #3 surface. Gray at all other window units**.
      b. Kind: Fully tempered.
   2. Lites: Two.
   3. Filling: Fill space between glass lites with **air at spandrel units and argon at all other units**.
   4. Low-E Coating: **On all units except spandrel**.

F. Glazing System: **Manufacturer's standard factory-glazing system that produces weathertight seal**.

G. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock fiberglass windows, and sized to accommodate sash weight and dimensions.
   1. Exposed Hardware Color and Finish: **Black**

H. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Dividers (False Muntins): Provide one horizontal divider grilles in each window unit at the exterior and interior.
   1. Quantity and Type: [**One horizontal centered in each window unit on both interior and exterior**.
   2. Material: Aluminum.
   3. Pattern: **As indicated on Drawings**.
   4. Profile: 1/2 inch deep x 1 5/8 inch tall.
   5. Color: **Black**.

2.5 FABRICATION

A. Fabricate fiberglass windows in sizes indicated. Include a complete system for installing and anchoring windows.
B. Glaze fiberglass windows in the factory.
C. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.

B. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 085413

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.
   3. Automatic operators.
   4. Cylinders specified for doors in other sections.

C. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
   8. State Building Codes, Local Amendments.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
   3. Content: Include the following information:
      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.

g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 5 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. Warranty Period: Unless otherwise indicated, warranty shall be five year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:
    a. Hager Companies (HA) - BB Series, 5-knuckle.
    b. McKinney (MK) - TA/T4A Series, 5-knuckle.
    c. dormakaba BEST (ST) - F/FBB Series, 5-knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
    1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
    2. Manufacturers:.
        a. Hager Companies (HA).
        b. Pemko (PE).

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
    1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
    2. Furnish dust proof strikes for bottom bolts.
    3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
    4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
    5. Manufacturers:
        a. Burns Manufacturing (BU).
        b. Door Controls International (DC).
        c. Rockwood (RO).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
    1. Manufacturers:
        a. Burns Manufacturing (BU).
        b. Door Controls International (DC).
        c. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
    1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
    2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
    3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
    4. Pulls shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
    5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
    6. Manufacturers:
        a. Burns Manufacturing (BU).

b. Hiawatha, Inc. (HI).
c. Rockwood (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.
1. Manufacturers:
a. ASSA ABLOY ACCENTRA (YA).

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer's Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

D. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).

E. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:
a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.7 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
1. Manufacturers:
a. ASSA ABLOY ACCENTRA (YA) 4700LN Series.
b. Arrow (AW) - QL Series.

2.8 DEADLOCKS AND LATCHES

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.
   1. Manufacturers:
      a. ASSA ABLOY ACCENTRA (YA) - 350 Series.
      b. Arrow (AW) - N Series.

2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
   1. Strikes for Mortise Locks and Latches: BHMA A156.13.
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
   1. Exit devices shall have a five-year warranty.
   2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
   3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
   4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
   5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
   6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
      a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
      b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
   7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Manufacturers:
a. ASSA ABLOY ACCENTRA (YA) - 7000 Series.
b. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.

C. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.
1. Static Load Force Resistance: Minimum 3000 lbs. certified independent tested.
2. Manufacturers:
a. ASSA ABLOY ACCENTRA (YA) - 7050 Series.
b. Corbin Russwin Hardware (RU) - ED4000S / ED5000S Series.

2.11 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
1. Manufacturers:
a. ASSA ABLOY ACCENTRA (YA) - 5800 Series.

2.12 ELECTROHYDRAULIC DOOR OPERATORS

A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up 250 pounds and 48" wide. Provide accessories such as custom templates, special mounting brackets, spacers and drop plates as needed for proper installation. Operators shall accommodate openings up to 200 pounds and 48" wide. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide operators with features as follows:
   a. Non-handed with push and pull side mounting.
   b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
   c. Activation by push button, hands-free or radio frequency devices.
   d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
   e. Two-year limited warranty.
   f. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
      1) Simple setup with no app required.
      2) View status and make adjustments without removing the cover.
      3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
   g. Mounting backplate to simplify and speed up installation.
2. Operators shall have the following functionality:
   a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
   b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
   c. Infinite Hold Open: Door will hold open at set position until power is turned off.
   d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
   e. Open Delay: Delays operator opening for locking hardware.
   f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
   g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
   h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
   i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
   j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
3. Manufacturers:
   a. LCN (LC) - 4630/4640 Series.
   b. Norton Rixson (NO) - 6000 Series.

2.13 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: ANSI A156.15, Grade 1 electromagnetic door holder/releases with a minimum 25 to 40 pounds holding power and fail-safe operation; power failure releases door to close.
   1. Manufacturers:
      a. Norton Rixson (NO) - 900 Series.
      b. Sargent Manufacturing (SA) - 1560 Series.

2.14 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1” less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.
   1. Provide protective trim with functions and features as follows:
      a. Meets ADA requirements for smooth bottom door surfaces.
      b. UL Classified options for use on fire-rated doors up to 3 hours.
      c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
      d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
      e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
      f. Fasteners included; adhesive-backed options available for select models.
      g. Ten-year limited warranty.
   2. Manufacturers:
      a. Burns Manufacturing (BU).
      b. Hager Companies (HA).
      c. Hiawatha, Inc. (HI).
      d. Rockwood (RO).

2.15 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
   1. Manufacturers:
      a. Burns Manufacturing (BU).
      b. Hager Companies (HA).
      c. Hiawatha, Inc. (HI).
      d. Rockwood (RO).

B. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
   1. Manufacturers:
      a. Norton Rixson (NO).
      b. Rockwood (RO).
      c. Sargent Manufacturing (SA).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko (PE).
3. Reese Enterprises, Inc. (RE).

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
   1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

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.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. YA - ASSA ABLOY ACCENTRA
5. RF - Rixson
6. NO - Norton
7. SU - Securitron

Hardware Sets

Set: 1.0
Doors: 101
Description: Exterior

1	Continuous Hinge	BSPFMSLI-HD1 or BSPFM SLF-HD1		PE	
1	Rim Exit Device, Exit Only	7155	BSP	YA	
2	Mortise Cylinder	2153 GMK	BSP	YA	
1	Rim Cylinder	1109 GMK	BSP	YA	
1	Door Pull	RM3311-36 Mtg-Type 12XHD	BSP	RO	
1	Conc Overhead Stop	6 Series	BSP	RF	
1	Automatic Opener	6021	BSP	NO	ϟ
1	Door Stop	462	US2C	RO	
1	Brush Sweep	345BSPNB x Door Width		PE	
1	Threshold	2005AT x Opening Width		PE	
2	Door Switch	505		NO	ϟ
1	Keyswitch	MK		SU	ϟ

Notes: Weatherstripping furnished by Aluminum Door Supplier.
Key switch MK will be used to turn power off/on to the door operator.
Key switch will be located on the wall next to the door opening.

Set: 2.0
Doors: 110, 111
Description: Exterior

Each Door:

1	Continuous Hinge	CFMHD1 x Door Height		PE
1	Rim Exit Device, Classroom	7150 PB626F	630	YA
1	Rim Cylinder	1109 GMK	626	YA
1	Surface Closer w/ HO	5831T SN-134	689	YA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Door Stop	462	US2C	RO
1	Gasketing	S773BL (Head & Jambs)		PE
1	Sweep	345ANB x Door Width		PE
1	Threshold	2005AT x Opening Width		PE

Set: 3.0
Doors: 102
Description: Existing Building (Rated)

3	Hinge, Full Mortise	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Communicating Lock	PB 4721LN GMK	626	YA
1	Surface Closer	P5801	689	YA
1	Electromagnetic Holder	998M	689	RF
1	Gasketing	S88BL (Head & Jambs)		PE

Set: 4.0
Doors: 105, 109
Description: Stairs, Basement Hatch

Each Door:

3	Hinge, Full Mortise	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom or Closet Lock	PB 4705LN GMK	626	YA
1	Surface Closer w/ HO	P5811	689	YA
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 5.0
Doors: 106
Description: Existing Building (Rated)

3	Hinge, Full Mortise	T4A4786 or T4A3786 NRP 5" x 4-1/2"	US26D	MK
1	Communicating Lock	PB 4721LN GMK	626	YA
1	Surface Closer	P5801	689	YA
1	Electromagnetic Holder	998M	689	RF
1	Gasketing	S88BL (Head & Jambs)		PE

Set: 6.0
Doors: 104
Description: Storage (Rated)

3	Hinge, Full Mortise	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom or Closet Lock	PB 4705LN GMK	626	YA
1	Surface Closer	P5801	689	YA
1	Gasketing	S88BL (Head & Jambs)		PE

Set: 7.0
Doors: 107, 108
Description: Women, Men

Each Door:

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Push Plate	70E	US32D	RO
1	Pull Plate	BF 107x70C	US32D	RO
1	Surface Closer w/ HO	P5811	689	YA
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 8.0
Doors: 112
Description: Kitchen

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Deadlock	356 GMK	626	YA
1	Push Plate	70E CFC	US32D	RO
1	Pull Plate	BF 107x70C CFTT	US32D	RO
1	Surface Closer w/ HO	P5811	689	YA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S88BL (Head & Jambs)		PE

Set: 9.0
Doors: B1
Description: Basement

3	Hinge, Full Mortise	T4A4786 or T4A3786 NRP 5" x 4-1/2"	US26D	MK
1	Storeroom or Closet Lock	PB 4705LN GMK	626	YA
1	Surface Closer w/ HO	5811	689	YA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 10.0 (ALT #1)
Doors: 113
Description: Table and Chairs Storage (Rated)

6	Hinge, Full Mortise	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Dust Proof Strike	570	US26D	RO
1	Set Auto Flush Bolts	2842 or 2942 as required	US26D	RO
1	Storeroom or Closet Lock	PB 4705LN GMK	626	YA
1	Coordinator	2600 x length required	Black	RO
2	Mounting Bracket	2601	Black	RO
2	Surface Closer	P5801	689	YA
2	Astragal	18041CNB x Door Height		PE
1	Gasketing	S88BL (Head & Jambs)		PE

Set: 11.0 (ALT #1)
Doors: 201
Description: Stairs

3	Hinge, Full Mortise	T4A4786 or T4A3786 NRP 5" x 4-1/2"	US26D	MK
1	Rim Exit Device, Nightlatch	7100 PB627F	630	YA
1	Rim Cylinder	1109 GMK	626	YA
1	Surface Closer w/ HO	P5811	689	YA
1	Wall Stop	409	US32D	RO
1	Gasketing	S88BL (Head & Jambs)		PE

END OF SECTION 08710

SECTION 08800

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Glass and glazing for Sections referencing this Section for products and installation.

1.02 PERFORMANCE REQUIREMENTS
A. Glass and glazing materials of this Section shall provide continuity of building enclosure vapor and air barrier:
1. To utilize the inner pane of multiple pane sealed units for the continuity of the air and vapor seal.
2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.
B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with IBC 2018 code.
C. Limit glass deflection to 1/200 flexure limit of glass with full recovery of glazing materials, whichever is less.

1.03 ENVIRONMENTAL REQUIREMENTS
A. Do not install glazing when ambient temperature is less than 50 degrees F.
B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.04 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated on shop drawings.

1.05 COORDINATION
A. Coordinate the Work with glazing frames, wall openings, and perimeter air and vapor seal to adjacent Work.

1.06 WARRANTY
A. Provide five year manufacturer's warranty.
B. Warranty: Include coverage for sealed glass units from seal failure, interpane dusting, or misting, reflective coating on mirrors, delamination of laminated glass and replacement of same.

PART 2 PRODUCTS

2.01 FLAT GLASS MATERIALS
A. Float Glass (Type FG): Clear, 1/4 inch thick minimum.
B. Safety Glass (Type SG): Clear; fully tempered with horizontal tempering 1/4 inch thick minimum at all locations where glass is less than 18 inches above finished floor.
C. Tinted Glass (Type TG): Float type, heat strengthened, light reducing, color (to be selected); 1/4 inch thick minimum.
D. Wire Glass (Type WG): Clear, polished both sides diagonal mesh of woven stainless steel wire of 1/2 inch grid size; 1/4 inch thick.
E. Mirror Glass (Type MG): Clear tempered safety type with copper and silver coating, organic overcoating, beveled edges, 1/4 inch thick minimum, and sizes, as indicated.
F. Shatter Resistant Glass: (Type SRG): Clear laminated, 3/4 inch composite - 3 - 1/4-inch thick laminated panels, sizes as indicated.

2.02 **SEALED INSULATING GLASS MATERIALS FOR STOREFRONT DOOR ONLY**
A. Insulated Glass Units (Type IG): ASTM E774 and E773; double pane with edge seal; outer pane of 1/4 inch clear tempered float glass with PPG Solarban70 #2 surface (Low-E), ½" air space with 90% Argon gas fill, inner pane of 1/4 inch clear tempered float glass.
1. IG Performance Requirements:
a. Light transmittance – 64%
b. U-value – Summer - .24
c. Solar heat gain coefficient - .27

2.03 GLAZING COMPOUNDS

A. Exterior windows not shop installed shall be glazed with vinyl or neoprene gaskets, extruded elastic polybutene tape sealant, a combination of polysulphide base compound and elastic glazing compound, or a combination of extruded polysulphide tape, polysulphide base compound elastic glazing compound.

B. Doors and interior stopped -in glass shall be glazed using putty or elastic glazing compound and stop beads.

C. Exterior glazing of steel sash shall be DAP Metal Glaze. Interior glazing of steel sash shall be DAP Steel Sash Putty.

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene or Silicone, 80 - 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene or Silicone, 50 - 60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 - 15 Shore A durometer hardness; coiled on release paper.

D. Glazing Clips: Manufacturer's standard type.

E. Mirror Attachment Accessories: Mirror adhesive, chemically compatible with mirror coating and wall substrate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install glazing in accordance with Flat Jobbers Association Glazing Manual.

3.03 INSTALLATION - MIRRORS

A. Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.

B. Place plumb and level.

3.04 CLEANING

A. Remove glazing materials from finish surfaces. Remove labels after work is complete. Clean glass and mirrors.

3.05 PROTECTION OF FINISHED WORK

A. After installation, mark pane with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION 08800

SECTION 09260

GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Metal stud wall framing.
- B. Acoustical insulation.
- C. Moisture resistant gypsum board.
- D. Taped and sanded joint treatment, **Level 5 finish**.

1.02 REFERENCES
- A. ASTM C36 - Gypsum Wallboard.
- B. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.
- C. ASTM C630 - Water Resistant Gypsum Backing Board.

PART 2 PRODUCTS

2.01 MANUFACTURERS - GYPSUM BOARD SYSTEM
- A. National Gypsum Company.
- B. Other acceptable manufacturers offering equivalent products.
- C. Substitutions: Under provisions of the General Requirements.

2.02 FRAMING MATERIALS
- A. Reference Section 9111 Metal Stud.

2.03 GYPSUM BOARD MATERIALS
- A. Fire Rated Moisture Resistant Gypsum Board: ASTM C36; Gypsum, Type "X" fire resistive type, UL rated; 5/8 inch thick, maximum permissible length; ends square cut, tapered edges. Product – **National Gypsum, Goldbond XP Fireshield**.

2.04 ACCESSORIES
- A. Acoustical Insulation: glass fiber, friction fit type, unfaced, 3 1/2 inch or 6 inch thick.
- B. Corner Beads: Metal.
- C. Edge Trim: GA 201 and GA 216; Type L bead.
- D. Joint Materials: ASTM C475; reinforcing tape, joint compound, adhesive, and water.
- E. Fasteners: ASTM C1002, Type S12, W, and GA-216.
- F. 1/2" Resilient Channel: Clark Dietrich, RC-1 Pro or equal.
- G. 7/8" Hat/Furring Channel: Clark Dietrich, 25 gauge.
- H. Molded Reveal Joints: Fry Reglet, ¼" x ¼"; DRM – 25 – 25.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.02 METAL STUD INSTALLATION
- A. Install studs in accordance with ASTM C754 and manufacturer's instructions.
- B. Metal Stud Spacing: 16 inches on center, unless noted otherwise.
- C. Refer to Drawings for indication of partitions, extend stud framing through the ceiling to the structure above, unless noted otherwise. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- D. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
- E. Blocking: Nail wood blocking to studs or Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, and hardware.

3.03 WALL FURRING INSTALLATION

A. Erect wall furring for direct attachment to concrete block walls.
B. Erect furring channels vertically; space maximum 16 inches on center, not more than 4 inches from floor and ceiling lines, abutting walls.
C. Install thermal insulation between furring channels directly attached to concrete masonry walls in accordance with manufacturer's instructions.
D. Erect free-standing metal stud framing tight to concrete masonry walls, attached by adjustable furring brackets in accordance with manufacturer's instructions.

3.04 FURRING FOR FIRE RATINGS

A. Install furring as required for fire resistance ratings indicated.
B. Columns in rated walls shall be wrapped independently from wall system.

3.05 CEILING FRAMING INSTALLATION

A. Coordinate location of hangers with other work.
B. Install ceiling framing independent of walls, columns, and above ceiling work.
C. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
D. Laterally brace entire suspension system.

3.06 ACOUSTICAL ACCESSORIES INSTALLATION

A. Install resilient channels at maximum 12 inches on center. Locate joints over framing members.
B. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

3.07 GYPSUM BOARD AND CEMENT BOARD INSTALLATION

A. Install gypsum board in accordance with manufacturer's instructions.
B. Erect single layer standard gypsum board vertical, with ends and edges occurring over firm bearing.
C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
D. Use screws when fastening gypsum board to metal furring or framing.
E. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.
F. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
G. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum board with sealant.
H. Place control joints consistent with lines of building spaces and as directed. Install at approximately 30' intervals in walls. Coordinate locations with Architect.
I. Place corner beads at external corners as indicated. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials as indicated.

3.08 JOINT TREATMENT

A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready for finishes.
B. Feather coats onto adjoining surfaces so that camber is maximum 1/32.
C. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.
D. Tape joints and corners of cementitious backing board using cement based joint compound as recommended by the manufacturer.
E. **Level 5 finish.**

3.09 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 09260

SECTION 09306

FLOOR AND WALL TILE

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Ceramic tile wall finish using the thinset application method.

1.02 SUBMITTALS
A. Submit under provisions of the General Requirements.
B. Product Data: Provide instructions for using adhesives and grouts.
C. Samples: Submit two samples illustrating pattern, color variations, and grout color.

1.03 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
B. Installer: Company specializing in performing the Work of this section with minimum five years documented experience, approved by manufacturer, and preapproved by architect (20 days) prior to bid.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle products to site.
B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.05 ENVIRONMENTAL REQUIREMENTS
A. Do not install adhesives in an unventilated environment.
B. Maintain 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE MANUFACTURERS
A. Architect to select at later date.

2.02 PORCELAIN WALL TILE MATERIALS
A. CT1 - Porcelain Wall Tile (Field Color): ANSI A137.1, Marazzi, Dare to be Bold, Modern Formation, conforming to the following:

1.	Size	12" x24"
2.	Shape	Rectangular, Light Polished
3.	Edge	Square
4.	Color	To be determined
5.	Pattern	Brickwork Vertical Narrow
6.	Grout	TEC, color to be determined with 1/8" joint

B. CT2 - Porcelain Wall Tile (Accent Color): ANSI A137.1, Marazzi, Dare to be Bold, Modern Formation, conforming to the following:

1.	Size	12" x13" Sheet
2.	Shape	Chevron, Light Polished
3.	Edge	Square
4.	Color	To be determined
5.	Pattern	Chevron
6.	Grout	TEC, color to be determined with 1/8" joint.

2.04 EXTRA MATERIALS
A. Provide one full carton of each color, style, or pattern.

2.05 BASE MATERIALS
A. Base: Match wall tile for moisture absorption, surface finish, and color:

2.06 ADHESIVE MATERIALS
A. Adhesives: Thinset bond type as recommended and/or manufactured by the tile manufacturer.

2.07 MORTAR MATERIALS
A. Mortar Materials: Portland cement, sand, latex additive, and water as recommended and/or manufactured by the tile manufacturer, color to be selected.

2.08 TRIM: Provide Schluter trim to comply with the following requirements:
A. External Corner: Schluter, Rondec. Clear Aluminum. Symmetrically rounded outer corners on walls. Depth to match tile thickness.
B. Internal Corners: Field-butted square corners.
C. Exposed Top Edge: Schluter, Jolly. Clear Aluminum. Depth to match tile thickness.

2.09 GROUT MIX
A. Mix and proportion pre-mix grout materials in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that surfaces are ready to receive work.

3.02 PREPARATION
A. Protect surrounding work from damage or disfiguration.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
D. Apply sealer conditioner to substrate surfaces in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - THINSET METHOD
A. Install adhesive tile, thresholds, and grout in accordance with manufacturer's instructions and/or the TCA Handbook.
B. Tile pattern to be determined. Do not interrupt tile pattern through openings.
C. Place Schlutter edge strips at exposed tile edges.
D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base, and wall joints.
E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
F. Sound tile after setting. Replace hollow sounding units.
G. Keep expansion, control joints free of adhesive or grout. Apply sealant to joints.
H. Allow tile to set for a minimum of 48 hours prior to grouting.
I. Grout tile joints.
J. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 CLEANING
A. Clean tile and grout surfaces.

3.05 PROTECTION OF FINISHED WORK
A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 09306

SECTION 09400

RESINOUS FLOORING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Sections, apply to work of this Section.

1.2 SUMMARY
- A. This Section includes the following:
  1. Seamless resinous flooring. Double Broadcast – Basis of Specification is **Desco Quartz Cremona TG**.
  2. Coved seamless wall base.

1.3 QUALITY ASSURANCE
- A. All materials must be recommended and manufactured by a single supplier to insure compatibility and proper chemical and mechanical bond.
- B. Surfacing shall be applied by a surfacing applicator approved by the Architect, with a minimum of five (5) years experience installing the brand of surfacing in similar size and function projects. A list of five (5) completed projects using the specified materials must be submitted proving five (5) years experience by the lead mechanic.
- C. Surfacing applicator shall provide to the architect a completed list of jobs including the names of the Architect, General Contractor, and Owner, telephone numbers of all concerned, materials used, quantity installed, and date completed on similar projects.
- D. Surfacing applicator must provide a written guarantee for materials and workmanship between applicator and surfacing manufacturer for one (1) year.
- E. Surfacing applicator or manufacturer seeking approval of products other than what is specified must supply samples, full product information, technical data with specifications, certification from an independent testing laboratory that the product being submitted for approval meets all requirements of the performance properties specified within this specification, installation instructions, and comply with the above quality assurances in writing.
- F. Bidders will be notified by addendum of substitute surfacing materials, if approved.
- G. Bidder may submit voluntary alternate system noting any variation from basis of specification. Include similar completed job references as indicated in 1.3.C, above. Acceptance of voluntary alternates is subject to review of owner/architect.

1.4 SUBMITTALS
- A. Surfacing applicator shall submit samples of color and textures for Owner's approval.
- B. Prior to commencing work, at Owner's discretion, applicator shall install a 100 square foot sample on the job of desired color and texture and when approved, this will serve as the standard for the entire project.

1.5 PRODUCT STORAGE AND ENVIRONMENTAL CONDITIONS
- A. Material temperatures shall be a minimum of 55ºF before use.
- B. Work on seamless flooring shall not commence until the building can be maintained at a minimum temperature of 55ºF for 48 hours before, during and 48 hours after application. Areas shall also be broom clean and reasonably dust free and shall have adequately controlled ventilation with bright, uniform lighting.

1.6 PROJECT CONDITIONS
- A. Before commencing work, ensure environmental and site conditions are suitable for application and curing.
- B. Surfaces shall be acceptable in accordance with flooring manufacturer's recommendations.
- C. Notify Architect and Owner in writing of unsuitable surfaces and conditions. Commencement of work shall imply acceptance of surfaces and working conditions.
- D. Recommended Moisture Vapor Transmission Considerations:
  1. Placement of on-grade slabs over a Class A vapor retarder as defined by ASTM E-145.
  2. A water cement ratio of 0.45 and 0.5.
  3. Curing by ASTM C-171 sheet materials for curing concrete.
  4. A slump in the range of 3 to 4 inches, which can be increased by the use of super plasticizers.
- E. Substrate requirements (**See Appendix A, this section**).

1.7 PROTECTION
- A. Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, cabinet work, equipment, etc. by suitable means.

1.8 WARRANTY

A. Applicator shall notify manufacturer of project requirements before bidding. Manufacturer shall provide written statement before bidding to the Architect that they accept single source warranty for entire installation including labor for one year. Warranty shall include removal and replacement if proven defective. Defective items are, but not limited to debonding, regionalized discoloration, excessive wear and staining by bodily fluids. Non-acceptance in writing by manufacturer is grounds for rejection of product.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Seamless Floor Covering where called for on the drawings, install a **Desco Quartz Cremona** Floor manufactured by Desco Coatings, Inc. **1-800-426-4164.**

B. Provide 4" high turned up coved base with 1" radius cove**.**

C. Binder and all successive grout and top coats shall be 100% solids clear/epoxy resin. Ceramic coated quartz aggregates as supplied by Desco Coatings are to be used to achieve all color. No pigmented epoxy base or top coats allowed.

D. Minimum Performance Characteristics:

1.	Compressive Strength (ASTM C-579)	10,700-11,000 psi
2.	Tensile Strength (ASTM C-307)	2,250 psi
3.	Flexural Strength	4,000 psi
4.	Shore D Hardness (ASTM D-2240)	85-90
5.	Bond Strength (ASTM D-4541)	425 psi
6.	Abrasion Resistance (ASTM D-4060)	0.08 gm
7.	Pot Life	35 min
8.	Cure Time @ 77˚ F	10-12 hours
9.	Flammability (ASTM D-635)	35-40 passes
10.	Impact Resistance (MIL-D-3135)	160 in/lb
11.	Indention (MIL-D-3134)	2,000 psi
12.	Tabor Abrasion w/aluminum oxide	25-30 mg loss

Epoxy top coats shall produce no color shift after exposure to fluorescent lighting on the “b” axis yellow index after 3 weeks exposure.

20% Hydrochloric Acid	10% Lactic Acid
Urine	Tea
Coffee	Mustard
Ethyl Alcohol	Mercurochrome
	Betadyne

E. Approved Manufacturers:

1. Stonehard, Products must meet or exceed specifications.
2. As approved by Addendum

PART 3 – EXECUTION

3.1 FLOORING PREPARATION

A. Surface must be clean, sound, and dry.

B. Effectively remove concrete laitance on accessible floor surfaces by mechanical shot blast. Acid etching is not acceptable.

C. Areas where flooring is existing must be cleaned to remove all floor material, grease, or any residue that might retard interfacial adhesion between substrate and surfacing.

D. Application of flooring implies that installer has performed test indicated in Paragraph 3.1, and slab is suitable for flooring installation.

3.3 FLOORING APPLICATION

A. Apply flooring in accordance with manufacturer's printed instructions, employing lead mechanic qualified under the quality assurance portion of this specification, using equipment specifically designed for this purpose.

B. Flooring System:

1. **Desco Quartz Cremona TG** is a trowel grade floor consisting of Desco quartz grade 28 aggregates. The system should be applied as trowel grade to produce a nominal 1/8” surfacing. Texture shall be medium.
2. **Color and texture to be selected from manufacturer’s full line.**

C. Install integral cove base to height of 4" with 1" radius cove as described in Paragraph 2.1.B.
    1. Trowel apply vertical cove base.
    2. Hand sand cove base.
    3. Apply three coats of resin to assure a smooth surface and cove.
    4. Do not allow resin to puddle in cove.

D. Finished work shall match approved samples; be uniform in thickness, sheen, color, pattern, and texture; and be free from defects detrimental to performance.

3.2 PROTECTION

A. After completion of flooring the General Contractor/Owner shall protect flooring from damage by other trades.

END OF SECTION 09400

(--Appendix A attached)

APPENDIX A

GENERAL SUBFLOOR REQUIREMENTS

CONTROL JOINTS

A. Control Joints. Slab is existing with small, patched areas. Installer shall verify joint locations and install flooring joints, fillers, etc. accordingly by methods below.

1. Install control and expansion joints in accordance with standard practice per ACI-501.

2. The floor contractor may fill non-moving control joint(s) with approved elastomeric sealant or full depth semi-rigid two-component epoxy joint filler, designed specifically for this purpose (use full depth joint filler when reinforcement of the joint edges is desirable), or two-component epoxy and filler (epoxy to be same material as flooring). Movement may crack surfacing unless proper detailing has been done.

3. Filling of moving isolation joints or expansion joints is not recommended.

4. Filling of non-moving isolation joints with elastomeric caulking and sealants or with a semi-rigid epoxy joint filler or two-component epoxy and filler is acceptable. Movement may crack surfacing unless proper detailing has been done.

5. Joint identified by owner/designer or general contractor as moving joints shall be treated by terminating flooring on each side of joint. After flooring is completed, joint shall then be filled by sealant contractor.

BACKING FOR COVE BASE

Surface to receive cove and/or base shall be strong, durable, and dry. Suitable backings include: Concrete, cement plaster, standard light-weight block, clay, sand-lime, cement bricks, and drywall with a toe plate. Masonry surface(s) to be free of voids, irregularities and recessed joints (if present, fill with recommended epoxy plaster).

SECTION 09511

SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Suspended metal grid ceiling system and perimeter trim.
- B. Acoustical tile.

1.02 SYSTEM DESCRIPTION
- A. Installed System: Conform to Fed. Spec. SS-S-118B flame spread 25 or under UL Labeled for ceiling assembly.
- B. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.03 SUBMITTALS
- A. Product Data: Provide data on metal grid system components, and acoustical units.
- B. Samples: Submit two samples illustrating material and finish of acoustical units.
- C. Samples: Submit two samples each, of suspension system main runner, cross runner, and edge trim.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.04 QUALIFICATIONS
- A. Grid and Tile Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Conform to applicable code for combustibility requirements for materials.

1.05 ENVIRONMENTAL REQUIREMENTS
- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.06 EXTRA MATERIALS
- A. Provide 40 sq. ft. of extra tile to Owner. (Each type.)

PART 2 PRODUCTS

2.01 MANUFACTURERS - SUSPENSION SYSTEM
- A. Armstrong Contract Interiors: Suprafine, 9/16” exposed tee grid, 2 x 2 at all areas.
- B. Substitutions: Under provisions of the General Requirements.

2.02 SUSPENSION SYSTEM MATERIALS
- A. Grid Materials
  1. Heavy-Duty Classification, Hot dipped galvanized steel with baked polyester paint at all areas.
- B. Exposed Grid Surface Width: 9/16 inch.
- C. Grid Finish: White.
- D. Accessories: Stabilizer bars, clips, splices, edge moldings, hold down clips, and light protection hoods required for rated suspended grid systems.
- E. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

2.03 MANUFACTURERS - ACOUSTICAL UNITS
- A. Armstrong Contract Interiors
  1. Type 1 (All locations unless noted otherwise): Calla High CAC #8807, angled tegular edge, 2’x2’x1”.
- B. Substitutions: Under provisions of the General Requirements.

2.04 ACCESSORIES
- A. Touch-up Paint: Type and color to match acoustical and grid units.
- B. Manufacturers accessories for complete and finished assembly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636 and manufacturer's instructions and as supplemented in this section.
B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
D. Locate system on room axis according to reflected plan.
E. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
F. Supply hangers or inserts for installation to Section with instructions for their correct placement.
G. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
I. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
J. Do not eccentrically load system, or produce rotation of runners.
K. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.
L. Form expansion joints as required or detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
M. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with UL assembly requirements.
N. Install additional hangers at fire rated ceiling assemblies, per manufacturer’s instruction or UL tested assembly.
O. Coordinate installation of suspension system with (but not limited too): Mechanical units, grilles, louvers, and lights.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.
B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
C. Lay directional patterned units one way with pattern parallel to shortest room axis. Fit border trim neatly against abutting surfaces.
D. Install units after above ceiling work is complete.
E. Install acoustical units’ level, in uniform plane, and free from twist, warp, and dents.
F. Cut tile to fit irregular grid and perimeter edge trim. Field rabbet tile edge. Double cut and field paint exposed edges of tegular units.
G. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions.
H. Install hold-down clips to retain panels tight to grid system as required for to meet ratings.
I. Coordinate installation of acoustical units with (but not limited too): Mechanical units, grilles, louvers, and lights.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

END OF SECTION 09511

SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Luxury vinyl tile flooring.
- B. Resilient base.

1.02 SUBMITTALS
- A. Product Data: Provide data on specified products, describing physical characteristics; sizes, patterns and colors available.
- B. Samples: Submit one sample, illustrating color and pattern for each floor material.
- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and seaming recommendations.

1.03 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing the Work of this section with minimum five years documented experience, approved by manufacturer, and preapproved by architect 20 days prior to bid.

1.04 REGULATORY REQUIREMENTS
- A. Conform to code for flame/smoke rating requirements in accordance with ASTM E84.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site under provisions of the General Requirements.
- B. Protect roll materials from damage.

1.06 ENVIRONMENTAL REQUIREMENTS
- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.07 MAINTENANCE DATA
- A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.08 EXTRA MATERIALS
- A. Provide 60 sql ft. of each flooring; 10 lineal feet of each base material specified.

PART 2 PRODUCTS

2.01 MATERIALS – LUXURY VINYL TILE FLOORING
- A. **J&J, Legend, 5mm. Color to be selected from manufacturer's full line.**

2.02 MATERIALS – RUBBER BASE
- A. Roppe, Pinnacle Rubber Base, 4 inch tall x 1/8 inch thick, coved, premolded external corners, roll goods (**strips not allowed). Color to be selected from manufacture's full line.**

2.03 ACCESSORIES
- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; **high moisture type** as recommended by flooring manufacturer.
- C. Edge Strips: Flooring material as approved.

PART 3 EXECUTION

3.01 PREPARATION
- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.
- D. Apply primer as recommended by manufacturer.

3.03 INSTALLATION – LUXURY VINYL TILE FLOORING
- A. Install in accordance with manufacturer's instructions.
- B. Mix tile from container to ensure shade variations are consistent when tile is placed.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place, press with heavy roller to attain full adhesion.
- E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
- F. Allow minimum 1/2 full size tile width at room or area perimeter.
- G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- H. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.
- I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - BASE
- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units or "V" cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.05 CLEANING
- A. Clean all work as described in the General Requirements.
- B. Remove access adhesive from floor, base, and wall surfaces without damage.
- C. Clean surfaces in accordance with manufacturer's instructions.

3.06 PROTECTION OF FINISHED WORK
- A. Protect finished Work.
- B. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION 09650

SECTION 09900

PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Surface preparation and field application of paints and coatings.

1.02 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum years documented experience and approved by manufacturer.

1.03 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.04 ENVIRONMENTAL REQUIREMENTS
- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

1.05 EXTRA MATERIALS
- **A. Provide one full gallon of each color to owner.**

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A. Manufacturer - Paint, Transparent Finishes, Stain, Primer Sealers, and Block Filler by SHERWIN-WILLIAMS or as approved equal.

2.02 MATERIALS
- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners, and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- C. Patching Materials: Latex filler.
- D. Fastener Head Cover Materials: Latex filler.

2.03 FINISHES
- A. Refer to schedule at end of section for surface finish schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

C. Seal with shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

F. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.

G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

H. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

J. Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.

K. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

L. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

M. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of trisodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

N. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

O. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand, power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

P. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

Q. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

R. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

S. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.

T. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

U. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease, and dirt.

V. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.03 APPLICATION

A. **Apply products in accordance with manufacturer's instructions.**
B. Do not apply finishes to surfaces that are not dry.
C. Apply each coat to uniform finish.
D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
E. Sand wood and metal lightly between coats to achieve required finish.
F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
G. Allow applied coat to dry before next coat is applied.
H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
I. Prime concealed surfaces of interior and exterior woodwork with primer paint.
J. Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
B. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars, and supports except where items are prefinished.
C. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
D. Paint exposed conduit and electrical equipment occurring in finished areas.
E. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 CLEANING

A. Collect waste material, which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 SCHEDULE

The following are for exterior and interior surfaces, and are all products of Sherwin-Williams.

EXTERIOR SURFACES

1. FERROUS METAL
   A. Painted (Gloss Finish/Alkyd Base)
      1st Coat: B50WZ0001 - Kem Kromik® Universal Metal Primer Off White
      2nd Coat: B66W00651 - Pro Industrial 0 VOC Acrylic Semi-Gloss Extra White
      3rd Coat: B66W00651 - Pro Industrial 0 VOC Acrylic Semi-Gloss Extra White

2. GALVANIZED and ALUMINUM METALS
   A. Painted (Semi-Gloss Finish/Latex Base)
      1st Coat: B66W00651 - Pro Industrial 0 VOC Acrylic Semi-Gloss Extra White
      2nd Coat: B66W00651 - Pro Industrical Zero VOC Acrylic Semi-Gloss
      3rd Coat: B66W00651 - Pro Industrical Zero VOC Acrylic Semi-Gloss

INTERIOR SURFACES

1. WOOD AND PLYWOOD
   A. Painted (Eg-Shel Finish/Alkyd Base)
      1st Coat: B51W08020 - Multi-Purpose Latex Primer White
      2nd Coat: B31W00051 - ProClassic® WaterBorne Interior Acrylic Semi-Gloss Extra White
      3rd Coat: B31W00051 - ProClassic® WaterBorne Interior Acrylic Semi-Gloss Extra White
   B. Stained and Varnished (Clear Finish) Opened Grained Wood
      1st Coat: S64T00008 - Sher-Wood® Wiping Stain Clear
      2nd Coat: T77F00037 - Sher-Wood® Catalyzed Lacquer PreCat Medium Rubbed Effect
      3rd Coat: T77F00037 - Sher-Wood® Catalyzed Lacquer PreCat Medium Rubbed Effect

2. GYPSUM WALLBOARD
   A. Painted (Eg-Shel Finish/Latex Base)
      1st Coat: B28W02600 - ProMar 200, Zero VOC Interior Latex Primer White
      2nd Coat: B20W02651 - ProMar 200 Zero VOC Interior Latex Eg-Shel Extra White
      3rd Coat: B20W02651 - ProMar 200 Zero VOC Interior Latex Eg-Shel Extra White

3. FERROUS METAL
   A. Painted (Semi-Gloss Finish/Alkyd Base)
      1st Coat: B66W00310 - Pro Industrial Pro-Cryl® Universal Primer Off White
      2nd Coat: B66W00651 - Pro Industrial 0 VOC Acrylic Semi-Gloss Extra White
      3rd Coat: B66W00651 - Pro Industrial 0 VOC Acrylic Semi-Gloss Extra White

4. GALVANIZED METAL/ALUMINUM
   A. Painted (Semi-Gloss Finish/Alkyd Base)
      1st Coat: B66W00310 - Pro Industrial Pro-Cryl® Universal Primer Off White
      2nd Coat: B66W00651 - Pro Industrial 0 VOC Acrylic Semi-Gloss Extra White
      3rd Coat: B66W00651 - Pro Industrial 0 VOC Acrylic Semi-Gloss Extra White

END OF SECTION 09900

SECTION 099723

CONCRETE AND MASONRY COLOR TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water Based Stain

1.2 REFERENCES

A. ASTM C 744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.

B. SCAQMDR 1168 - South Coast Air Quality Management District's (SCAQMD) Volatile Organic Compounds (VOC) Rule 1168.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Product characteristics.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Preliminary Samples: To be provided as required for the specific project.

D. Verification Samples: To be provided on the specific materials to be treated when they are available in plant or on site.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: An international manufacturer with a minimum of 20 years of experience in the production of the stains and coatings of type specified.

B. Installer Qualifications: Installer licensed by Nawkaw to apply the stain products specified and with a minimum of three years documented experience in applying stains and coatings similar in type and scale to this Project.

C. Environmental Regulations: The masonry stain material to be applied is in compliance with federal, provincial and local environmental Volatile Organic Compounds (VOC) regulations.

D. Mock-Up: Apply a minimum one square foot sample of each type of color application required.

1. Finish areas designated by Architect.
2. Prepare each sample in an area where it will be exposed to the same conditions as will be present on the building during curing.
3. Samples should be viewed from a minimum distance of 20 feet.
4. Do not proceed with remaining work until color and finish is approved by Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and handle products in accordance with requirements of manufacturer.

C. Store materials inside if possible, away from open flame. Store in a secure area to avoid tampering and contamination. Water-based materials must be kept from freezing.

1.6 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.

1.7 WARRANTY

A. At project closeout, provide to Owner or Owner's Representative an executed copy of the manufacturer's standard limited warranty against manufacturing and workmanship defects, outlining its terms, conditions, and exclusions from coverage.
   1. Duration: 25 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Nawkaw Corporation, which is located at: 370 Commerce Blvd; Athens, GA 30606; Toll Free Tel: 866-462-9529; Tel: 706-355-3217; Fax: 706-355-9199; Email: info@nawkaw.com; Web: http://www.nawkaw.com/
B. Substitutions: Not permitted.
C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 WATER-BASED STAIN

A. NawTone (Formerly NECT-90):
   1. General: NawTone: high-quality, water-based, highly permeable acrylic stain. Mold, mildew, UV and weather resistant.
   2. Properties:
      • Viscosity: (72° F) 70°-90° KU
      • pH: 8.5-9.5
      • Finish: flat
      • Nonflammable (ASN/ZS 1530.3-1999)
      • VOC: < 5 g/L (SCAQMDR 1168)
      • Abrasion Resistance: excellent
      • Freeze/Thaw Test (ASTM C216-86): exceeded
      • Salt Attack Resistance (AS/NZS 4456.10): no blisters
      • Water Vapor Transmission (ASTM E96-05) 0.337 g/hr m^2
      • Water Vapor Permeance (ASTM E96-05) 6.6x10-8 g/Pa s m^2
      • UV Resistant–Accelerated Weathering
      (ASTM G154:2000, ASTM G53-88, D2244-89) 2000 hrs: excellent
   3. **Finish Color: To match existing original "red" masonry. Submit sample to Architect for approval prior to work commencing.**

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Verify that new masonry and concrete have cured at least 21 days prior to applying NawTone.
C. Verify that surfaces being color treated with NawTone have a neutral pH, are clean, dry and free of efflorescence.
D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
B. Clean surfaces thoroughly prior to installation. Allow surfaces to dry completely before applying coating.

C. Verify that walls, masonry, concrete, stucco, block split faced/fluted and mortar that may have been treated with any form of chemical/acid wash are neutralized.
D. Treat alkali or efflorescence with proper neutralizing compounds as recommended by masonry supplier before stain application.
E. Before application, verify that the masonry walls have a neutral pH.
F. Before application, verify that surface to be treated is clean, dry and contains no frozen water.
G. Mix products as recommended immediately prior to application.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Apply stain using airless spray pump to help control airborne particles or overspray. If site conditions prohibit spray application, apply by hand; utilizing brushes and rollers.
C. Do not proceed with work when ambient temperatures are less than 25 degrees F (-4 degrees C) or greater than 110 degrees F (43 degrees C).
D. Allow manufacturer's specified drying time for each coat before applying next coat (if required).
E. Verify color consistency. Recoat areas where blotches, blemishes or imperfections are present.

3.4 FIELD QUALITY CONTROL

A. Verify color consistency. Recoat any areas that are unacceptable.

3.5 PROTECTION

A. Protect installed products until completion of project.
B. Protect prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels as required.
C. Protect shrubs, metal, wood trim, glass, asphalt and other building hardware during application from overspray.
D. Do not permit mist (if spraying) or liquid to drift onto surrounding properties or parking lots.
E. Touch-up, repair or replace damaged products before substantial completion.

END OF SECTION 099723

SECTION 09985

SANITARY WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 1 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. Provide all labor, materials, etc., necessary for the completion of the Work of this Section.

B. This Section includes the following:
1. Extruded rigid plastic wainscot panels on **both** Restrooms (48" high) walls, **per Deduct Alternate #9.**

1.3 QUALITY CONTROL

A. Source Limitations: Obtain each color, grade, finish, and type of impact-resistant wall protection system component from a single source with resources to provide components of consistent quality in appearance and physical properties.

B. Fire-Test-Response Characteristics: Provide impact-resistant wall protection system components with the following surface-burning characteristics, as determined by testing materials identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify impact-resistant wall protection system components with appropriate markings of applicable testing and inspecting agency.
1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

C. Impact Strength: Provide impact-resistant wall protection system components with a minimum impact resistance of 25.4 ft-lbf/in. of width when tested according to ASTM D 256, Test Method A.

1.4 DELIVERY AND STORAGE

A. All materials shall be inspected immediately upon delivery and report any defects

B. Remove panels from shipping skid and restack on a solid, flat, dry surface

C. Lay panels flat. Do not store on edge.

D. Panels shall be acclimated at least 24 hours in temperature and humidity conditions approximating the operating environment of the finished room.

1.5 SUBMITTALS

A. Equal substitutions must be submitted to the architect for verification no later than ten (10) calendar days prior to Bid date.

1.6 **EXTRA MATERIALS**

A. Impact Resistant Wall protection Systems Units: Full size units of maximum length, including vinyl plastic cover and aluminum retainer, equal to 2 percent of each type, color and texture of each type of unit installed, but not less than two (2) units.

1. Include accessory components required. Replacement materials shall be from the same production run as materials installed. Package replacement materials with protective covering identified with appropriate labels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
   1. Koroseal Wall Protection Systems, Inc.
   2. IPC Door and Wall Protection Systems, Inc.
   3. Acrovyn Wall Protection Systems.

2.2 MATERIALS

A. Extruded Rigid Plastic: textured, chemical and stain resistant, high impact resistant, PVC or acrylic modified vinyl plastic; thickness as indicated; with a minimum impact resistance of 25.4 ft-lbs/in of width tested according to ASTM D 256, Test Method A. **Thickness: .040"**

B. **Color: Chosen by Architect/Owner from full range of colors.**
Any panels discolored, dirty, or varying in color are not acceptable.

2.3 MOLDINGS AND TRIM

A. All exposed panel edges and joints in panels shall be finished with appropriate one-piece or two-piece nonstaining vinyl extruded moldings in a color to match panels. Trim shall be manufactured and recommended by panel manufacturer: Trim pieces shall be as follows:
   1. Capping Strip: "J" shaped.
   2. Division Bar: "H" shaped.
   3. Inside or Outside Corner: Oversized "F" shaped for specific corner designation.

2.4 SEALANT

A. High quality clear silicone sealant in accordance with manufacturer's recommended installation procedures.

2.5 FASTENERS

A. Non-corroding mechanical. Truss head nylon drive rivits. Fastener holes shall be pre-drilled slightly oversize.

B. Metal fasteners are not acceptable.

C. Exposed fasteners shall match panel color. Field painting is not acceptable.

EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which impact-resistant wall protection system components and impact-resistant wall covering materials will be installed.

B. Complete finishing operations, including painting and wall covering before installing impact-resistant wall protection system components.

C. Impact-Resistant Wall Covering Materials: Wall surfaces to receive impact-resistant wall covering materials shall be dry and free from dirt, grease, loose paint, and scale.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Expansion: Leave not less than 1/4" gap at ceiling and floor, 1/8" gap between wall panels for normal expansion and contraction. Confirm these dimensions with panel manufacturer. Allow not less than 1/8" gap around pipes, electrical fittings and other projections. Fill gaps with flexible, silicone based caulking to complete moisture seal

F. Fastener Positioning: Install fasteners not further than 8" apart around outside edges and 12" apart on intermediate 16" centers. Stagger fasteners on opposing panel edges. Outside fasteners shall be approximately 1" from panel edge.

G. Sealing and Caulking: Caulk all corner seams, ceiling and base junctions and fasteners holes.

3.2 INSTALLATION

A. General: Before installation, clean substrate to remove dust, debris, and loose particles.

B. Install impact-resistant wall protection system components level, plumb, and true to line without distortions.

1. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

C. Install aluminum retainers, mounting brackets, and other accessories according to the manufacturer's written instructions.

1. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run.

3.3 CLEANING

A. Upon completion of installation of panels, clean down all walls and ceilings.
B. Supply Owner with instructions for maintenance of materials.
C. Any panels, trim or fasteners found to be unacceptable to Owner or Architect will be replaced.

END OF SECTION 09985

SECTION 10160

SOLID PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Plastic laminate faced solid phenolic toilet compartments; floor mounted, overhead braced.

1.02 SUBMITTALS
- A. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, and door swings.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Samples: Submit two samples illustrating panel finish, color, and sheen.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.03 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings and instructed by the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURER
- A. GENERAL PARTITIONS - Solid phenolic (black core). **Architect to select color from full range.**

2.02 MATERIALS
- A. Sheet: High Pressure laminate bonded to solid phenolic core.
- B. Core Construction: Solid Phenolic core.
  1. 1" thick pilasters.
  2. ¾" thick doors.
  3. ½" thick panels.

2.03 ACCESSORIES
- A. Pilaster Shoe: Formed chromed steel with polished finish, 3 inches high, with adjustable screw jack.
- B. Attachments, Screws, and Bolts: Stainless steel; vandal resistant type, heavy duty extruded aluminum brackets.
- C. Hardware: Chrome plated non-ferrous cast metal:
  1. Pivot hinges, gravity type, adjustable for door close positioning.
  2. Nylon bearings.
  3. Thumb turn door latch with exterior emergency access feature.
  4. Door strike and keeper with rubber bumper.
  5. Coat hook with rubber bumper.
  6. **Full length aluminum angle mounting brackets with associated fasteners for panels and pilasters where intersect walls.**

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify correct spacing of and between plumbing fixtures.
- B. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION
- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets with tamper proof through bolts and nuts. Locate head rail joints at pilaster center lines.
- E. Anchor urinal screen panels to walls with panel brackets.
- F. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- G. Support pilasters from built-in framing using two adjustable hanging studs providing vertical leveling. Conceal ceiling fastenings with pilaster shoe.

H. Equip each door with two hinges, one door latch, one coat hook and bumper; out-swinging door with pull.

I. Install door strike and keeper with door bumper on each pilaster in alignment with door latch.
J. Replace damaged or scratched materials with new materials.

3.03 ERECTION TOLERANCES
A. Maximum Variation From True Position: 1/4 inch.
B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING
A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
B. Adjust hinges to position doors in open position when unlatched. Return outswinging doors to closed position.
C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10160

SECTION 10522

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Fire extinguishers. (6-total)
- B. Cabinets. (3-total)
- C. Accessories.

1.02 SUBMITTALS
- A. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, and location.
- B. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.03 OPERATION AND MAINTENANCE DATA
- A. Maintenance Data: Include test, refill, or recharge schedules and recertification requirements.

1.04 ENVIRONMENTAL REQUIREMENTS
- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A. LARSEN'S - Architectural Series SS 2409-R4, Solid Door, baked enamel interior finish.
- B. Substitutions: Under provisions of the General Requirements.

2.02 EXTINGUISHERS
- A. Dry Chemical Type: Larsen's MP series MP10 (10 lb.), Cast steel tank, with pressure gage.
- B. Quantity: 6-total.

2.03 CABINETS
- A. Metal: Formed sheet steel, baked enamel box.
- B. Configuration:
  1) Semi-recessed type, exterior nominal dimensions of 27 1/2 inch high x 13 inch wide x 6 inch deep – 3-total.
- C. Trim Type: Returned to wall surface, with 3 1/2 inch projection.
- D. Door and Trim: **Stainless Steel**, reinforced for flatness and rigidity; latch with solid door.
- E. Door Lettering: Horizontal die cut.
- F. Cabinet Mounting Hardware: Appropriate to cabinet.

2.04 FABRICATION
- A. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
- B. Pre-drill for anchors.
- C. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.
- D. Weld, fill, and grind components smooth.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Verify exact location with Architect prior to framing walls.
B. Install in accordance with manufacturer's instructions.
C. Install cabinets plumb and level in wall openings, 24 inches from finished floor to inside bottom of cabinet.
D. Secure rigidly in place.
E. Place extinguishers in cabinets.

END OF SECTION 10522

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Toilet and washroom accessories including grab bars.
- B. Attachment hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A. BOBRICK WASHROOM EQUIPMENT INC, or BRADLEY CORPORATION.
- B. Substitutions: Under provisions of the General Requirements.

2.02 FABRICATION
- A. Weld and grind joints of fabricated components, smooth.
- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1 1/2 inches clear of wall surface. Knurl grip surfaces.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.

2.03 FINISHES
- A. Galvanizing: ASTM A123 to 1.25 oz. /sq. yd. Galvanize ferrous metal and fastening devices.
- B. Chrome/Nickel Plating: ASTM B456, satin finish.
- C. Stainless Steel: No. 4 satin luster finish.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings and instructed by the manufacturer.
- B. Verify exact location of accessories for installation. Coordinate with ADA requirements.

3.02 PREPARATION
- A. Deliver inserts and rough-in frames to site for timely installation. Provide templates and rough-in measurements as required.

3.03 INSTALLATION
- A. Install accessories in accordance with manufacturer's instructions and Americans with Disabilities Act. Also reference ANSI A117.1.
- B. Install plumb and level, securely and rigidly anchored to substrate.

3.04 SCHEDULE (**Install All Handicap Accessories per 2010 ADAAG Requirements**)
- A. Grab Bars (Two Sets Total): Install at handicap water closet, mount 36 inches A.F.F. Bradley #812-001-36 and #812-001-42.
- B. Frameless Mirror Units (Two Total): Install bottom at 38 inches A.F.F. and centered above lavatory. Bradley #747, 56 inches wide x 48 inches tall. Install ceramic tile around mirror.
- C. Surface Mounted Toilet Tissue Dispensers (Four Total): Install one adjacent to each water closet, mount top of unit at 30 inches A.F.F. and centerline of unit at 8 inches from front edge of toilet. Bradley #5425.
- D. Automatic Roll Paper Towel Dispenser (Four Total): Mount bottom of unit at 40 inches A.F.F. Bradley 2494. Locate within trash unit.

E. Recessed Mounted Combination Paper Towel Dispenser/Trash Receptacle (Four Total): Mount bottom of unit at 6 inches A.F.F. 18 gallon waste container. **No upper door.** Does not include dispenser. Bradley 2271.

F. Surface Mounted Sanitary Napkin Receptacle (Three Total): Install one adjacent to each Women's water closet, mount top of unit at 30 inches A.F.F. and centerline of unit at 18 inches from rear wall. Bradley #4722-15.

G. Utility Shelf with Mop/Broom Holders and Rag Holders (One Total): Mount on wall at Janitor #106. Coordinate height and exact location with architect prior to installation. Bradley #9983.

END OF SECTION 10800

SECTION 10850

BUILDING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building specialties shall be furnished and installed as shown and herein specified. Installation shall be in accordance with the respective manufacturer's instructions. Certain manufacturer's products have been selected as a basic standard, and reference to these products has been made. Other manufacturers' products of equal capacities and design characteristics may be used, if approved by the Architect prior to the Bidding. The Contractor shall submit for approval shop drawings or standard cuts and illustrations or a combination thereof showing all items he proposes to use.

1.02 INTERIOR BUILDING SIGNAGE

A. Contractor shall include in his bid an allowance of $500 for the purchase, delivery, and installation of interior building signage for both restrooms. All signage shall comply with 2010 ADA Standards as well as 2018 IBC requirements. Submit signage to architect for approval prior to ordering. Owner to select from manufacturer's full range of colors.

1.03 INTERIOR SOUND DOOR AT KITCHEN

A. Provide and install Overly Door Company, 3'-0"x6'-8", Series SCW, sound door and 2" x 5 3/8" wide frame with 15" wide x 20" tall 3/8" thick clear annealed laminated glass. Coordinate color of door laminate with Architect.

1.04 POLYVINYL CHLORIDE (PVC) INTERIOR TRIM

A. Provide and install Royal Building Products pvc trim per Drawings. Trim styles consist of:
   1. 1x3 Wainscot Base **#2566**. White.
   2. 9/16x7 1/4 Colonial Base L738 **#9869**. White.
   3. 1/2x4 1/4 Colonial Base 620 **#9873**. White.
   4. 1/2 Flat. White.

1.05 FIBERGLASS REINFORCED PLASTIC PANELING – SPECIFIED WALLS AT JANITOR #106 AND KITCHEN #108

A. Product - Class A – Minimum .090 thickness panel. Include Manufacturer's vinyl molding at all corners, transitions, joints, and tops, bottoms, etc.

B. Product shall be applied using manufacturer recommended adhesive and manufacturer recommended mechanical fasteners. Pre-drill rivet holes and silicone caulk prior to riveting.

C. Product shall be as per: Panolam, Embossed. Color to be selected from manufacturer's full range. 12' tall sheets.

END OF SECTION 10850

SECTION 210500 **- COMMON WORK RESULTS FOR FIRE SUPPRESSION**

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes:
   1. Sleeves without waterstop.
   2. Sleeves with waterstop.
   3. Stack-sleeve fittings.
   4. Sleeve-seal systems.
   5. Grout.
   6. Silicone sealants.
   7. Escutcheons.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. For each type of product, excluding motors which are included in Part 1 of the fire-suppression equipment Sections.
      a. Include construction details, material descriptions, and dimensions of components.
      b. Include operating characteristics and furnished accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES AND SLEEVE SEALS

A. Sleeves without Waterstop:
   1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
   2. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
   3. Steel Sheet Sleeves: ASTM A653/A653M, 24 gauge minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.
   4. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
   5. Molded-PVC Sleeves: With nailing flange.
   6. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange.

B. Sleeve-Seal Systems:
   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. Advance Products & Systems, LLC
      b. CALPICO, Inc.
      c. GPT; a division of EnPRO Industries
      d. Metraflex Company (The)
      e. Proco Products, Inc
   2. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
      a. Hydrostatic Seal: 20 psig minimum.
      b. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
      c. Pressure Plates: Carbon steel or Composite plastic.
      d. Connecting Bolts and Nuts: Carbon steel, with ASTM B633 coating of length required to secure pressure plates to sealing elements.

C. Grout:
1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

2.2 ESCUTCHEONS

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. BrassCraft Manufacturing Co.; a Masco company
2. Dearborn Brass
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The)
5. Mid-America Fittings, LLC; A Midland Industries Company
6. ProFlo; a Ferguson Enterprises, Inc. brand

B. Escutcheon Types:
1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Stainless Steel Type: With polished stainless steel finish.
3. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

C. Floor Plates:
1. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE LOOPS AND SWING CONNECTIONS

A. Install pipe loops and offsets in accordance with NFPA 13 requirements for expansion and contraction compensation.

3.2 INSTALLATION OF SLEEVES, GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout or silicone sealant, seal space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire-resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in other sections.

3.3 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width centered in concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using grout or silicone sealant, seal space around outside of sleeves.

3.4 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.5 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

3.6 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:
1. Perform the following tests and inspections:
   a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
   b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
2. Prepare test and inspection reports.

B. Escutcheons:
1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.7 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above and below Grade:
   a. Sleeves with waterstops.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
2. Concrete Slabs-on-Grade:
   a. Sleeves with waterstops.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs above Grade:
   a. Sleeves with waterstops.

4. Interior Walls and Partitions:
    a. Sleeves without waterstops.

3.8 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping and Relocated Existing Piping:
1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Chrome-Plated Piping: One piece, steel or split plate steel with polished, chrome-plated finish.
3. Insulated Piping:
    a. One piece, steel with polished, chrome-plated finish.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
    a. One piece, steel with polished, chrome-plated finish.
5. Bare Piping at Ceiling Penetrations in Finished Spaces:
    a. One piece, steel with polished, chrome-plated finish.
6. Bare Piping in Unfinished Service Spaces:
    a. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
7. Bare Piping in Equipment Rooms:
    a. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.

B. Install floor plates for piping penetrations of equipment room floors.

C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. New Piping and Relocated Existing Piping: One piece, floor plate.
2. Existing Piping: Split floor plate.

END OF SECTION 210500

SECTION 210523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Indicator posts.
9. Trim and drain valves.

1.2 DEFINITIONS

A. NRS: Nonrising stem.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
1. Fire Main Equipment: HAMV - Main Level.
a. Indicator Posts, Gate Valve: HCBZ - Level 1.
b. Ball Valves, System Control: HLUG - Level 3.
c. Butterfly Valves: HLXS - Level 3.
d. Check Valves: HMER - Level 3.
e. Gate Valves: HMRZ - Level 3.

2. Sprinkler System and Water Spray System Devices: VDGT - Main Level.
    a. Valves, Trim and Drain: VQGU - Level 1.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NFPA Compliance for Valves:
1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.

E. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.3 TWO-PIECE BALL VALVES WITH INDICATORS

A. 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. Ames Fire & Waterworks; A Watts Water Technologies Company
2. NIBCO INC.
3. Victaulic Company

B. Description:
1. UL 1091, except with ball instead of disc and FM Global approved for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.4 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. 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. ALEUM USA
2. Globe Fire Sprinkler Corporation
3. Milwaukee Valve Company

B. Description:
1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.

5. Stem Material: Bronze or stainless steel.
6. Disc: Bronze or Stainless steel with EPDM coating.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.5 IRON BUTTERFLY VALVES WITH INDICATORS

A. 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. ALEUM USA
2. Anvil; an ASC Engineered Solution
3. Globe Fire Sprinkler Corporation
4. Kennedy Valve Company; a division of McWane, Inc.
5. NIBCO INC.
6. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
7. Victaulic Company
8. Zurn Industries, LLC

B. Description:
1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer.

2.6 CHECK VALVES

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. ALEUM USA
2. Anvil; an ASC Engineered Solution
3. Globe Fire Sprinkler Corporation
4. Kennedy Valve Company; a division of McWane, Inc.
5. NIBCO INC.
6. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
7. Victaulic Company
8. Zurn Industries, LLC

B. Description:
1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.7 BRONZE OS&Y GATE VALVES

A. 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. Milwaukee Valve Company
   2. NIBCO INC.
   3. United Brass Works, Inc
   4. Zurn Industries, LLC

B. Description:
   1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
   2. Minimum Pressure Rating: 175 psig.
   3. Body and Bonnet Material: Bronze or brass.
   4. Wedge: One-piece bronze or brass.
   5. Wedge Seat: Bronze.
   6. Stem: Bronze or brass.
   7. Packing: Non-asbestos PTFE.
   8. Supervisory Switch: External.
   9. End Connections: Threaded.

2.8 IRON OS&Y GATE VALVES

A. 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. American Cast Iron Pipe Company
   2. Clow Valve Company; a subsidiary of McWane, Inc.
   3. FNW; Ferguson Enterprises, Inc.
   4. Hammond Valve
   5. Kennedy Valve Company; a division of McWane, Inc.
   6. Mueller Co. LLC; Mueller Water Products, Inc.
   7. NIBCO INC.
   8. Victaulic Company
   9. WATTS; A Watts Water Technologies Company
   10. Zurn Industries, LLC

B. Description:
   1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
   2. Minimum Pressure Rating: 175 psig.
   3. Body and Bonnet Material: Cast or ductile iron.
   4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
   5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
   6. Stem: Brass or bronze.
   7. Packing: Non-asbestos PTFE.
   8. Supervisory Switch: External.
   9. End Connections: Flanged.

2.9 NRS GATE VALVES

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. American Cast Iron Pipe Company
   2. Clow Valve Company; a subsidiary of McWane, Inc.
   3. Mueller Co. LLC; Mueller Water Products, Inc.
   4. NIBCO INC.
   5. Victaulic Company
   6. Zurn Industries, LLC

B. Description:
1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged.

2.10 INDICATOR POSTS

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. American Cast Iron Pipe Company
2. Clow Valve Company; a subsidiary of McWane, Inc.
3. Kennedy Valve Company; a division of McWane, Inc.
4. Mueller Co. LLC; Mueller Water Products, Inc.
5. NIBCO INC.

B. Description:
1. Standard: UL 789 and FM Global standard for indicator posts.
2. Type: Upright.
3. Base Barrel Material: Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.
6. Operation: Handwheel.

2.11 TRIM AND DRAIN VALVES

A. Ball Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Apollo Valves; a part of Aalberts Integrated Piping Systems
b. Croker; a Division of Morris Group International
c. Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International
d. Flowserve Corporation
e. Jomar Valve
f. KITZ Corporation
g. Metso Automation USA Inc.
h. Milwaukee Valve Company
i. NIBCO INC.
j. Potter Roemer LLC; a Division of Morris Group International
k. Red-White Valve Corp.
l. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
m. Victaulic Company
n. WATTS; A Watts Water Technologies Company
o. Zurn Industries, LLC
2. Description:
a. Pressure Rating: 175 psig.
b. Body Design: Two piece.
c. Body Material: Forged brass or bronze.
d. Port size: Full or standard.
e. Seats: PTFE.

f. Stem: Bronze or stainless steel.
g. Ball: Chrome-plated brass.
h. Actuator: Handlever.
i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:
1. 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. Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International
b. NIBCO INC.
c. United Brass Works, Inc
2. Description:
a. Pressure Rating: 175 psig.
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:
1. 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. NIBCO INC.
b. United Brass Works, Inc
2. Description:
a. Pressure Rating: 175 psig.
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION, GENERAL

A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:

1. Section 211000 "Water-Based Fire-Suppression Systems" for application of valves in fire-suppression standpipes; wet-pipe, fire-suppression sprinkler systems; and dry-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply, except from fire-department connections. Install permanent identification signs, indicating portion of system controlled by each valve.

C. Install double-check valve assembly in each fire-protection water-supply connection.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION 210523

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SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports for fire-suppression piping - metal.
   2. Pipe hangers for fire-suppression piping - metal, trapeze type.
   3. Fastener systems.
   4. Equipment supports.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers.
   2. Equipment supports.

C. Delegated Design Submittals: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of trapeze hangers.
   2. Include design calculations for designing trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment are to withstand the effects of gravity loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7.
   1. Design supports for multiple pipes, including pipe stands capable of supporting combined weight of supported systems, system contents, and test water.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.2 PIPE HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING - METAL

A. Pipe Hangers and Supports for Fire-Suppression Piping - Carbon Steel:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anvil; an ASC Engineered Solution
   b. Cooper B-line; brand of Eaton, Electrical Sector
   c. FNW; Ferguson Enterprises, Inc.
2. Description: Factory-fabricated components, NFPA approved, UL listed, or FM Global approved for fire-suppression piping support.
3. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Pipe/Tube Hangers and Supports for Fire-Suppression Piping - Copper:
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. Anvil; an ASC Engineered Solution
   b. Cooper B-line; brand of Eaton, Electrical Sector
   c. FNW; Ferguson Enterprises, Inc.
2. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM Global approved for fire-suppression piping support.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 PIPE HANGERS FOR FIRE-SUPPRESSION PIPING - METAL, TRAPEZE TYPE

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM Global-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 FASTENER SYSTEMS

A. Fastener System - NFPA/UL/FM Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM Global-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. 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. Cooper B-line; brand of Eaton, Electrical Sector
   b. Empire Industries, Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
   e. MKT Fastening, LLC
2. Indoor Applications: Zinc coated or Stainless.
3. Outdoor Applications: Stainless steel.

2.5 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM Global-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.6 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000 psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Division 07 Firestopping section for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry static loads within specified loading limits. Minimum static design load used for strength determination is to comply with NFPA 13 requirements, minimum 5 times the water-filled weight of piping and supported components plus 250 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

B. Install lateral bracing with pipe hangers and supports to prevent swaying.

C. 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. Coordinate location of concrete inserts before concrete is placed.

D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

E. Pipe Slopes: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

F. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

G. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel in accordance with AWS D1.1/D1.1M.

H. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

I. Fastener System Installation:
   1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners in accordance with manufacturer's written instructions. Install in accordance with approvals and listings.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation:
   1. Fabricate from welded-structural-steel shapes.
   2. Grouting: Place grout under supports for floor-mounted equipment and make bearing surface smooth.
   3. Provide lateral bracing, to prevent swaying.

3.3 INSTALLATION OF EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup:
1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless steel pipe hangers and stainless steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.

3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Comply with NFPA requirements.

K. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

L. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

M. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529

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SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe labels.
   2. Stencils.
   3. Valve tags.
   4. Warning tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: Provide for fire-suppression piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
   2. Brady Corporation
   3. Carlton Industries, LP
   4. Champion America
   5. Craftmark Pipe Markers
   6. emedco
   7. Kolbi Pipe Marker Co.
   8. LEM Products Inc.
   9. Marking Services Inc.
   10. Pipemarker.com; Brimar Industries, Inc.
   11. Seton Identification Products; a Brady Corporation company

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

F. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include the following:
   1. Pipe size.
   2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.

3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.2 VALVE TAGS

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. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
   2. Brady Corporation
   3. Carlton Industries, LP
   4. Champion America
   5. Craftmark Pipe Markers
   6. emedco
   7. Kolbi Pipe Marker Co.
   8. LEM Products Inc.
   9. Marking Services Inc.
   10. Pipemarker.com; Brimar Industries, Inc.
   11. Seton Identification Products; a Brady Corporation company

B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.04 inch stainless steel, 0.024 inch aluminum, 0.031 inch or anodized aluminum, 0.031 inch thick, with predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire, link chain, beaded chain, or S-hook.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Include valve-tag schedule in operation and maintenance data.

2.3 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Brady Corporation
   2. Champion America
   3. Craftmark Pipe Markers
   4. emedco
   5. Kolbi Pipe Marker Co.
   6. LEM Products Inc.
   7. Marking Services Inc.
   8. Pipemarker.com; Brimar Industries, Inc.
   9. Seton Identification Products; a Brady Corporation company

B. Description: Preprinted accident-prevention tags, of plasticized card stock.
   1. Size: 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. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Within 3 ft. of each valve and control device.
   2. At access doors, manholes, and similar access points that permit a view of concealed piping.
   3. Within 3 ft. of equipment items and other points of origination and termination.
   4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.

C. Flow- Direction Arrows: Provide arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Fire-Suppression Pipe Label Color Schedule:
   1. Fire-Suppression Pipe Labels: White letters on an ANSI Z535.1 safety-red background.

3.4 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule in the operating and maintenance manual. Include the identification "FSV" on all fire-suppression system valve tags.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below.
   1. Valve-Tag Size and Shape:
      a. Fire-Suppression Standpipe: 1-1/2 inches, round.
      b. Wet-Pipe Sprinkler System: 1-1/2 inches, round.
      c. Dry-Pipe Sprinkler System: 1-1/2 inches, round.
      d. Preaction System: 1-1/2 inches, round.
   2. Valve-Tag Color: White letters on an ANSI Z535.1 safety-red background.

3.5 INSTALLATION OF WARNING TAGS

A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.

B. Attach warning tags, with proper message, to equipment and other items where indicated on Drawings.

END OF SECTION 210553

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SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire-suppression piping, fittings, and appurtenances.
2. Fire department connections.
3. System control valves.
4. Dry-sprinkler system.
5. Fire-suppression piping specialties.
6. Sprinklers.
7. Alarm devices.
8. Pressure gauges.

1.2 ACTION SUBMITTALS

A. Product Data:
1. For each type of product.
   a. Include construction details, material descriptions, dimensions of individual components and profiles.
   b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
1. Prior to preparation of shop drawings, convene a meeting including General Contractor and all subcontractors potentially impacted by installation of fire protection piping systems, to facilitate coordination of installation of all impacted systems. Submittal of plans and calculations is acknowledgement that coordination has been performed. Rework in the field due to conflicts between fire protection systems and other systems will be performed at no cost to the Owner, Architect, or Engineer.
2. Prepare in accordance with NFPA 13 section "Working Plans."
   a. Include plans, elevations, and sections of the system piping and details.
   b. Include detailed riser diagram and schematic diagram showing system supply, supply connection, devices, valves, pipe and fittings, as well as the delineation of the standard-pressure and high-pressure portions of the fire-suppression system.
   c. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Prepare computer-generated hydraulic calculations in accordance with the following:
   a. Minimum operating pressure at hydraulically most remote fire hose valve is to be 100 psig.
   b. Name of hydraulic program used.
   c. Water supply information, including fire hydrant flow test data report.
4. Submit documents and calculations signed and sealed by qualified professional engineer responsible for their preparation
5. Include diagrams for power, signal, and control wiring.

C. Delegated Design Submittals: For fire-suppression systems indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Fire-suppression system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.
1. Prior to full submittal, provide a coordination submittal indicating locations and types of all sprinkler heads coordinated with the Architects reflected ceiling plan. Additionally, indicate proposed locations of all exposed piping for review.

2. Following approval of the initial coordination submittal described above, submit complete layout and calculations.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data: Approved fire-suppression piping working plans, prepared in accordance with NFPA 13, including documented approval by AHJs, and including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:
1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-suppression systems and specialties to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code.

1.7 FIELD CONDITIONS

A. Interruption of Existing Fire-Suppression Service: Do not interrupt fire-suppression service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression service in accordance with requirements indicated:
1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-suppression service.
2. Do not proceed with interruption of fire-suppression service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Automatic wet-pipe sprinkler system.

B. Automatic dry-pipe sprinkler.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Suppression System Components, Devices, and Accessories: Listed in ULSE's "Fire Protection Equipment Directory" and FM Approvals' "Approval Guide."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fire-suppression system equipment, specialties, accessories, installation, and testing to comply with NFPA 13, and ASME A17.1.

D. Standard-Pressure Piping System Component: Listed for 175 psig minimum working pressure.

E. Delegated Design: Engage a qualified professional engineer to design fire-suppression systems.
   1. Fire-Hydrant Flow Test:
      a. Perform fire-hydrant flow test and record the following conditions:
         1) Date:.
         2) Time:
         3) Performed by: .
         4) Location of Residual Fire Hydrant R: Insert location.
         5) Location of Flow Fire Hydrant F: Insert location.
         6) Static Pressure at Residual Fire Hydrant R:.
         7) Measured Flow at Flow Fire Hydrant F:.
         8) Residual Pressure at Residual Fire Hydrant R:.
      b. Fire-hydrant flow test must be performed within previous 12 months prior to completion of design documents and hydraulic calculations.
   2. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   3. Sprinkler Occupancy Hazard Classifications: per NFPA 13.
   4. Minimum Density for Automatic-Sprinkler Piping Design: Per NFPA 13.
   5. Maximum protection area per sprinkler in accordance with ULSE listing.
   6. Total Combined Hose-Stream Demand Requirement: In accordance with NFPA 13 unless otherwise indicated or required by Authority Having Jurisdiction.
   7. Minimum residual pressure at each hose-connection outlet is as follows:
      a. NPS 1-1/2 (DN 40) Hose Connections: 65 psig.
      b. NPS 2-1/2 (DN 65) Hose Connections: 100 psig.

F. Obtain documented approval of fire-suppression system design from AHJs.

2.3 FIRE-SUPPRESSION PIPING, FITTINGS, AND APPURTENANCES

A. Steel Pipe, Fittings, and Appurtenances:
   1. Schedule 40 Steel Pipe: black-steel pipe, ASTM A53/A53M, ASTM A135/A135M, or ASTM A795/A795M.
      a. Standards:
         1) UL 852.
         2) FM 1630.
      b. Factory-applied exterior coating.
      c. Factory-applied bacterial-resistant internal coating to reduce microbiologically influenced corrosion.
      d. Pipe ends may be factory or field formed to match joining method.
   2. Steel Pipe Nipples: Galvanized and black steel, ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
   3. Steel Couplings: Galvanized steel, ASTM A865/A865M, threaded.
   4. Gray-Iron Threaded Fittings: Galvanized gray-iron threaded fittings, ASME B16.4, Class 125, standard pattern.
   5. Malleable- or Ductile-Iron Unions: ASME B16.3.
   6. Cast-Iron Flanges: ASME B16.1, Class 125.
   7. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

a. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.
   1) Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
   2) Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
b. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1 carbon steel unless otherwise indicated.

8. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
   a. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
9. Plain-End-Pipe Fittings:
   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) Gruvlok; an ASC Engineered Solution
      2) Shurjoint; a part of Aalberts Integrated Piping Systems
      3) Victaulic Company
   b. Pressure Rating: 175 psig minimum.
   c. Plain-End Fittings for Steel Piping: Painted plain-end fittings, ASTM A53/A53M, carbon steel or ASTM A106/A106M, forged steel with dimensions matching steel pipe.
   d. Plain-End-Pipe Couplings for Steel Piping: Rigid pattern for steel-pipe dimensions, ductile-iron or malleable-iron housing. Include EPDM-rubber gasket, and bolts and nuts.
10. Grooved-Joint, Steel-Pipe Appurtenances:
   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) CPS Products, Inc.
      2) Gruvlok; an ASC Engineered Solution
      3) Shurjoint; a part of Aalberts Integrated Piping Systems
      4) Smith-Cooper International
      5) SPF/Anvil; an ASC Engineered Solution
      6) Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
      7) Victaulic Company
   b. Pressure Rating: 175 psig minimum.
   c. Grooved-End Fittings for Steel Piping: Painted grooved-end fittings, ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
   d. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connection, Flush Type:
   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. Croker; a Division of Morris Group International
      b. Elkhart Brass Mfg. Co., Inc
      c. Guardian Fire Equipment, Inc
      d. Potter Roemer LLC; a Division of Morris Group International
      e. Wilson & Cousins Inc.
   2. Standard: UL 405.
   3. Description: Flush, for wall mounting.
   4. Pressure Rating: 175 psig minimum.
   5. Body Material: Corrosion-resistant metal.
   6. Inlets: Brass with threads in accordance with NFPA 1963 and matching local fire department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Escutcheon Plate Marking: "AUTO SPKR".
12. Finish: Rough brass or bronze.

2.5 SYSTEM CONTROL VALVES

A. Listed in ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."

B. Pressure Rating:
1. Standard-Pressure Piping Valves: 175 psig minimum.
2. High-Pressure Piping Valves: 300 psig.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. System Control Valve, Alarm Valve:
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. Reliable Automatic Sprinkler Co., Inc. (The)
   b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
   c. Venus Fire Protection Ltd.
   d. Victaulic Company
   e. Viking Group Inc.
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, and fill-line attachment with strainer.
5. Drip cup assembly pipe drain with check valve to main drain piping.

G. System Control Valve, Dry-Pipe Valve:
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. Reliable Automatic Sprinkler Co., Inc. (The)
   b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
   c. Venus Fire Protection Ltd.
   d. Victaulic Company
   e. Viking Group Inc.
2. Standards:
   a. UL 260.
   b. UL 1486.
3. Design: Differential-pressure type.
4. Include quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
5. Air Compressor for Dry-Pipe Valve:
   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) Gast Manufacturing Inc
      2) General Air Products, Inc
      3) Viking Group Inc.
   b. Motor Horsepower: Fractional.

c. Power: 120 V ac, 60 Hz, single phase.
d. Sized for application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA standards. Provide ASME air receiver tank as required to meet requirements on larger systems.
e. Include filters, relief valves, coolers, automatic drains, and gauges.

2.6 FIRE-SUPPRESSION PIPING SPECIALTIES

A. Branch Outlet Fittings:
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. Shurjoint; a part of Aalberts Integrated Piping Systems
b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
c. Victaulic Company
2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:
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. AGF Manufacturing, Inc.
b. Reliable Automatic Sprinkler Co., Inc. (The)
c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
d. Victaulic Company
2. Standard: ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:
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. AGF Manufacturing, Inc.
b. Croker; a Division of Morris Group International
c. [**Potter Roemer LLC; a Division of Morris Group International**]
2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:
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. AGF Manufacturing, Inc.
b. Reliable Automatic Sprinkler Co., Inc. (The)
c. Viking Group Inc.

2. Standard: ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:
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. Aegis Technologies, Inc.
2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:
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. ALEUM USA
   b. Easyflex, Inc.
   c. Flexhead; an ASC Engineered Solution
   d. Gateway Tubing, Inc.
   e. Reliable Automatic Sprinkler Co., Inc. (The)
   f. Victaulic Company
2. Standards:
   a. UL 2443.
   b. FM 1637.
3. Description: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

G. Automatic (Ball-Drip) Drain Valves:
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. Reliable Automatic Sprinkler Co., Inc. (The)
   b. Viking Group Inc.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

H. Manual Air Vent/Valve:
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. AGF Manufacturing, Inc.
2. Description: Ball valve that requires human intervention to vent air.
3. Body: Forged brass.
4. Ends: Threaded.
5. Minimize Size: 1/2 inch.
6. Minimum Water Working Pressure Rating: 300 psig.

I. Automatic Air Vent:
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. AGF Manufacturing, Inc.

b. CLA-VAL
c. Engineered Corrosion Solutions
d. Metraflex Company (The)
e. Reliable Automatic Sprinkler Co., Inc. (The)

2. Description: Automatic air vent that automatically vents trapped air without human intervention. Approved for use in wet-pipe fire-suppression system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

J. Automatic Air Vent Assembly:
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. AGF Manufacturing, Inc.
b. Engineered Corrosion Solutions
c. South-Tek Systems, LLC
2. Description: Automatic air vent assembly that automatically vents trapped air without human intervention, including Y-strainer and ball valve in a pre-piped assembly. Approved for use in wet-pipe fire-suppression system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

2.7 SPRINKLERS

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. Reliable Automatic Sprinkler Co., Inc. (The)
2. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
3. Victaulic Company
4. Viking Group Inc.

B. Standards:
1. UL 199.
2. UL 1626.
3. UL 1767.
4. FM 2000.
5. FM 2008.
6. FM 2030.

C. Listed in ULSE's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."

D. Pressure Rating for Sprinklers:
1. Standard Automatic Sprinklers: 175 psig minimum.
2. Residential Sprinklers: 175 psig maximum.

E. Sprinklers, Automatic Wet with Heat-Responsive Element:
1. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
2. Standard Spray, Standard Response:
a. Upright.
b. Flat, concealed pendent.
c. Horizontal sidewall.
3. Standard Spray, Quick Response:
a. Upright.
b. Flat, concealed pendent.
c. Horizontal sidewall.

d. Flat, concealed horizontal sidewall.

F. Sprinklers, Automatic Dry with Heat-Responsive Element:
1. Standard Spray, Standard Response:
a. Flat, concealed pendent.
2. Standard Spray, Quick Response:
a. Flat, concealed pendent.
b. Flat, concealed horizontal sidewall.

G. Sprinkler Finishes: painted white.

H. Sprinkler Escutcheons: Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

I. Sprinkler Guards and Water Shields:
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. Reliable Automatic Sprinkler Co., Inc. (The)
b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America
c. Victaulic Company
d. Viking Group Inc.
2. Standard: UL 199.
3. Description: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Match alarm-device material and connection types to piping and equipment materials and connection types.

B. Water-Motor-Operated Alarm:
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. Reliable Automatic Sprinkler Co., Inc. (The)
b. Victaulic Company
c. Viking Group Inc.
2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inch diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Electrically Operated Notification Appliances:
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. Notifier; Honeywell International, Inc.
b. Potter Electric Signal Company, LLC
2. Electric Bell:
a. Standard: UL 464.
b. Type: Vibrating, metal alarm bell.
c. Size: 6-inch minimum- diameter.
d. Voltage: 24 V dc.
e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.
3. Strobe/Horn:
a. Standard: UL 464.

b. Tone: Selectable, steady, Temporal-3 (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
c. Voltage: 120 V ac, 60 Hz.
d. Effective Intensity: 110 cd.
e. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for "Fire."
f. Sign, Integrated: Mount between backbox and strobe/horn with text visible on both sides, above and below strobe/horn. Housing to be shaped to cover surface-mounted weatherproof backbox. Sign is to consist of white lettering on red plastic identifying it as a "Sprinkler Fire Alarm" and instructing viewers to call 911, police or fire department.

D. Water-Flow Indicators:
1. 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. Potter Electric Signal Company, LLC
b. System Sensor; Honeywell International, Inc.
c. Viking Group Inc.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125 V ac and 0.25 A, 24 V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

E. Pressure Switches - Water-Flow Alarm Detection:
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. Potter Electric Signal Company, LLC
b. System Sensor; Honeywell International, Inc.
2. Description: Electrically supervised, pressure-activated water-flow switch with retard feature.
3. Components: Two single-pole, double-throw switches with normally closed contacts.
4. Design Operation: Rising pressure to 6 psi, plus or minus 2 psi signals water flow.
5. Adjustability: Each switch is to be independently adjustable.
6. Wire Separation: Pressure switch to provide for separation of wiring to each switch connection to allow for low- and high-voltage connections to comply with NFPA 70, Article 760 requirements.

F. Pressure Switches - Low/High Air Pressure Supervisory:
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. Potter Electric Signal Company, LLC
b. System Sensor; Honeywell International, Inc.
2. Description: Electrically supervised pressure supervisory switch.
3. Components: Two single-pole, double-throw switches.
4. Design Operation: Detects increase and/or decrease from normal supervisory air pressure.
5. Adjustability: Each switch is to be independently adjustable.
6. Wire Separation: Pressure switch to provide for separation of wiring to each switch connection to allow for low- and high-voltage connections to comply with NFPA 70, Article 760 requirements.

G. Valve Supervisory Switches:
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. Kennedy Valve Company; a division of McWane, Inc.
b. Potter Electric Signal Company, LLC
c. System Sensor; Honeywell International, Inc.
2. Standard: UL 346.

3. Type: Electrically supervised.
4. Design: Signals that controlled valve is in other than fully open position.
5. Wire Terminal Designations: Indicates normal switch position when switch is properly installed on valve and valve is fully open.
6. 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.
7. OS&Y Valve Supervisory Switches:
    a. One or two single-pole, double-throw switches.
    b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
    c. Visual Switch Indication: Indicates device is properly installed and OS&Y valve is fully open.
    d. Mounting Hardware: Mounting bracket to grip valve yoke and prevent movement of switch assembly on OS&Y valve.
    e. Trip Rod Length: Adjustable
8. Butterfly Valve Supervisory Switches:
    a. Two single-pole, double-throw switches.
    b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
    c. Mounting Hardware: Removable nipple.
    d. Trip Rod Length: Adjustable
9. Ball Valve Supervisory Switches:
    a. One single-pole, double-throw switch.
    b. NEMA Rating: NEMA 4 enclosure suitable for mounting in any position indoors or outdoors.
    c. Mounting Hardware: Suitable for mounting directly to pipe, ball valves, or backflow preventers sized from up to NPS 2.

H. Indicator-Post Supervisory Switches:
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. Potter Electric Signal Company, LLC
    b. System Sensor; Honeywell International, Inc.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.9 PRESSURE GAUGES

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. AGF Manufacturing, Inc.
2. Ametek U.S. Gauge
3. Ashcroft Inc
4. Brecco Corporation
5. WIKA Instrument Corporation

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gauge Range: 0 to 250 psig minimum.

E. Water System Piping Gauge: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gauge: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test. Use results for system design calculations required in "Quality Assurance" Article.
   1. Flow test is to be performed to meet the criteria established by [**NFPA 13**][**and**][**NFPA 14**].
   2. Flow test is to be conducted in accordance with NFPA 291.
   3. Test is to be performed during a period of ordinary demand for the water system.
      a. To obtain satisfactory test results of expected flow or rated capacities, sufficient discharge should be achieved to cause drop of at least 10 percent.
   4. Pitot readings are to be taken at the 2-1/2-inch orifice connection.
   5. The pitot reading is to range from 10 to 35 psig.
   6. Open additional hydrant outlets as needed to control pitot readings.
   7. The pitot pressure and corresponding residual pressure readings are to be taken consecutively as pressure fluctuates between a high number and low number.

B. Flow Test Data Written Report:
   1. Flow data report is to be written in accordance with NFPA 291.
   2. Flow data report is to include a copy of all flow data recorded during the test, including a site plan showing the tested fire hydrants with respect to the fire water service to the building. Site plan is to indicate which hydrant was flowed and which hydrant was used for pressure reading. Provide date of test, name of testing agency, and name of individual performing test.

C. Water Supply Curve: Provide water supply curve based on the lowest supply for a given set of test data. For a given residual pressure reading, the supply is to be graphed utilizing the corresponding pitot pressure/flow reading and static pressure reading.

D. Documentation is to include calibration certifications for gauges used in the flow tests. The certifications are to be from within the previous six (6) months from a reputable agency recognized for certifying pressure gauges.

E. Report flow test results promptly and in writing. A copy of the flow test data report is to be submitted with the hydraulic calculations.

3.2 INSTALLATION OF FIRE-SUPPRESSION WATER-SERVICE PIPING

A. Connect to utility water service. Comply with requirements for fire-suppression water-service piping in Section "Site Water Distribution Piping" as applicable.

3.3 INSTALLATION OF FIRE-SUPPRESSION PIPING

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
   1. Deviations from approved working plans for piping require written approval from AHJs. File written approval with Architect before deviating from approved working plans.
   2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 and NFPA 14 requirements for installation of fire-suppression piping.

C. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install inspector's test connections in sprinkler system piping, complete with shutoff valve, and sized and located in accordance with NFPA 13.

G. Install fire-suppression system piping with drains for complete system drainage. Extend drain piping to exterior of building where possible.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valve at each check valve for fire department connection, to drain piping between fire department connection and check valve. Install drain piping to and spill over floor drain or to exterior of building.

J. Install alarm devices in piping systems.

K. Install hangers and supports for fire-suppression piping in accordance with NFPA standards. Comply with requirements for hanger materials in NFPA standards.

L. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe/sprinkler supply. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.

M. Pressurize and check dry-pipe standpipe or sprinkler system piping and air compressors.

N. Fill wet-type fire-suppression system piping with water.

O. Drain dry-type fire-suppression system piping.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210500 "Common Work Results for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210500 "Common Work Results for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210500 "Common Work Results for Fire-Suppression Piping."

3.4 INSTALLATION OF PIPING JOINTS

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts in accordance with ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints in accordance with AWS D10.12M/D10.12, using qualified processes and welding operators in accordance with "Quality Assurance" Article.
   1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints.

M. Brazed Joints: Join copper tube and fittings in accordance with Copper Development Association's "Copper Tube Handbook," "Brazed Joints" chapter.

N. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints.

O. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

P. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

Q. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
   1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
   2. CPVC Piping: Join in accordance with ASTM D2846/D2846M Appendix.

3.5 INSTALLATION OF FIRE DEPARTMENT CONNECTIONS

A. Install wall-type fire department connections.

B. Install protective pipe bollards around each fire department connection.

C. Install automatic (ball-drip) drain valve at each check valve for fire department connection.

3.6 INSTALLATION OF VALVES AND SPECIALTIES

A. Install listed fire-suppression system control valves, trim and drain valves, specialty valves and trim, controls, and specialties in accordance with manufacturer's installation instructions, NFPA standards, and AHJ.

B. Install listed fire-suppression system shutoff valves in supervised open position, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. System Control Valves:
   1. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
   2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball-drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
      a. Install air compressor and compressed-air-supply piping.

D. Air Vent:
   1. Provide at least one air vent at high point in each wet-pipe fire-suppression system in accordance with NFPA standards. Connect vent into top of fire-suppression piping.

2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
3. Pipe from outlet of air vent to drain.

3.7 INSTALLATION OF SPRINKLERS

A. Install sprinklers in suspended ceilings symmetrically in center of acoustical ceiling panels within tolerance of 1/2 inch. Coordinate entire pattern of sprinkler locations with approved reflected ceiling plan.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping in accordance with requirements for identification specified in Section 210553 "Identification for Fire-Suppression Piping and Equipment."

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Perform the following tests and inspections :
1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect fire-suppression systems in accordance with NFPA standards.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire department equipment.
9. Verify that sprinklers' original factory finish has not been contaminated with dirt, debris, or paint. Sprinklers containing other-than-original factory finish are to be considered defective and replaced with new products. Repair and/or cleaning is not acceptable.

C. Fire-suppression piping system will be considered defective if it does not pass tests and inspections.

D. Fire-suppression piping system components considered defective during testing will be replaced with new components. Repair of defective components is not acceptable.

E. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from fire-suppression system piping, system control valves, sprinklers, and associated components.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2 (DN 50) and Smaller, to Be One of the Following:
   1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
   3. Schedule 40, black-steel pipe with [**cut-**][**or**][**roll-**]grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   4. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   5. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
   6. Schedule 10, steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   7. Schedule 10, steel pipe with plain ends; welding fittings; and welded joints.

D. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), to Be One of the Following:
   1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
   3. Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   4. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   5. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

E. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 5 (DN 125) and Larger, to Be One of the Following:
   1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
   3. Schedule 40, black-steel pipe with [**cut-**][**or**][**roll-**]grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   4. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   5. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: Flat concealed sprinklers.
   3. Wall Mounting: Flat concealed sidewall sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.
   1. Upright, Pendent, and Sidewall Sprinklers: White enamel in finished spaces exposed to view; rough bronze in unfinished spaces and locations not generally exposed to view.
   2. Recessed Sprinklers: White enamel, with factory-painted white escutcheon.
   3. Flat Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

END OF SECTION 211000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Motors.
2. Packless expansion joints.
3. Grooved-joint expansion joints, lead free.
4. Alignment guides and anchors.
5. Sleeves without waterstop.
6. Sleeves with waterstop.
7. Stack-sleeve fittings.
8. Sleeve-seal systems.
9. Grout.
10. Silicone sealants.
11. Escutcheons.
12. Thermometers, bimetallic actuated, lead free.
13. Thermometers, filled system, lead free.
14. Thermometers, liquid in glass, lead free.
15. Thermowells, lead free.
16. Pressure gauges, dial type, lead free.
17. Gauge attachments, lead free.
18. Test plugs, lead free.
19. Test-plug kits, lead free.
20. Sight flow indicators, lead free.

1.2 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 ACTION SUBMITTALS

A. Product Data:
1. For each type of product, excluding motors which are included in Part 1 of the plumbing equipment Sections.
a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
b. Include operating characteristics and furnished accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of expansion joint, and gauge to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

1.7 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water expansion fittings and loops for plumbing piping intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.

C. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.2 MOTORS

A. Motor Requirements, General:
   1. Content includes motors for use on alternating-current power systems of up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
   2. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
   3. Comply with NEMA MG 1 unless otherwise indicated.
   4. Comply with IEEE 841 for severe-duty motors.

B. Motor Characteristics:
   1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 ft. above sea level.
   2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Polyphase Motors:
   1. Description: NEMA MG 1, Design B, medium induction motor.
   2. Efficiency: Premium Efficient, as defined in NEMA MG 1.
   3. Service Factor: 1.15.
   4. Multispeed Motors: Variable torque.
      a. For motors with 2:1 speed ratio, consequent pole, single winding.
      b. For motors with other than 2:1 speed ratio, separate winding for each speed.
   5. Multispeed Motors, Two Winding: Separate winding for each speed.
   6. Rotor: Random-wound, squirrel cage.
   7. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
   8. Temperature Rise: Match insulation rating.
   9. Insulation: Class F.
   10. Code Letter Designation:
      a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
      b. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
   11. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Additional Requirements for Polyphase Motors:
   1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
   2. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
      a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time-rise pulses produced by pulse-width-modulated inverters.
      b. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
      c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
      d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
   3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:
   1. Motors larger than 1/20 hp must be one of the following, to suit starting torque and requirements of specific motor application:
      a. Permanent-split capacitor.
      b. Split phase.
      c. Capacitor start, inductor run.
      d. Capacitor start, capacitor run.
   2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
   3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
   4. Motors 1/20 HP and Smaller: Shaded-pole type.
   5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device will automatically reset when motor temperature returns to normal range.

F. Electronically Commutated Motors:
   1. Microprocessor-Based Electronic Control Module: Converts 120 V or 240 V single-phase AC power to three-phase DC power to operate the brushless DC motor.
   2. Three-phase power motor module with permanent magnet rotor.
   3. Circuit board or digital speed controller/LED display.
   4. Building Automation System Interface: Via DC voltage signal or Digital Serial Interface (DSI).

2.3 EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

A. Performance Requirements:
   1. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
   2. Capability: Provide products and installations that will accommodate maximum axial movement as scheduled or indicated on Drawings.

B. Packless Expansion Joints:
   1. Flexible-Hose Packless Expansion Joints, Lead Free:.
      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) ASC Engineered Solutions
         2) Flex-Hose Co., Inc
         3) Flex-Pression
         4) Flex-Weld; a division of Kelco
         5) Flexicraft Industries
         6) Kadant Unaflex, LLC
         7) Mason Industries, Inc.

8) Proco Products, Inc
9) Unisource Manufacturing, Inc.
10) Metraflex

b. Source Limitations: Obtain flexible-hose packless expansion joints from single manufacturer.
c. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
d. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
e. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.
1) Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
f. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with threaded end connections.
1) Stainless steel hoses and single-braid, stainless steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

C. Alignment Guides and Anchors:
1. Alignment Guides:.
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) Advanced Thermal Systems, Inc
2) ASC Engineered Solutions
3) Flex-Hose Co., Inc
4) Flex-Weld; a division of Kelco
5) Flexicraft Industries
6) Hyspan Precision Products, Inc
7) Metraflex Company (The)
b. Source Limitations: Obtain alignment guides from single manufacturer.
c. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe. Provide dielectric spacer for use with copper tubing/piping.
2. Anchor Materials:
a. Steel Shapes and Plates: ASTM A36/A36M.
b. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
c. Washers: ASTM F844, steel, plain, flat washers.
d. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
1) Stud: Threaded, zinc-coated carbon steel.
2) Expansion Plug: Zinc-coated carbon steel.
3) Washer and Nut: Zinc-coated carbon steel.
e. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
1) Bonding Material: ASTM C881/C881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
2) Stud: ASTM A307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
3) Washer and Nut: Zinc-coated carbon steel.

2.4 SLEEVES AND SLEEVE SEALS

A. Sleeves without Waterstop:
1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.

2. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
3. Steel Sheet Sleeves: ASTM A653/A653M, 24 gauge minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.
4. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
5. Molded-PVC Sleeves: With nailing flange.
6. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange.

B. Sleeves with Waterstop:
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. Advance Products & Systems, LLC
   b. American Polywater Corporation
   c. CALPICO, Inc.
   d. GPT; a division of EnPRO Industries
   e. Metraflex Company (The)
2. Description: Manufactured PVC/HDPE, steel, stainless steel, or galvanized-steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Stack-Sleeve Fittings:
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. Jay R. Smith Mfg Co; a division of Morris Group International
   b. Wade; a subsidiary of McWane Inc.
   c. Zurn Industries, LLC
2. Description: Manufactured, galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
   a. Underdeck Clamp: Clamping ring with setscrews.

D. Sleeve-Seal Systems:
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. Advance Products & Systems, LLC
   b. American Polywater Corporation
   c. GPT; a division of EnPRO Industries
   d. Metraflex Company (The)
   e. Proco Products, Inc
2. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   a. Hydrostatic Seal: 20 psig minimum.
   b. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   c. Pressure Plates: Carbon steel.
   d. Connecting Bolts and Nuts: Carbon steel, with zinc coating, ASTM B633 of length required to secure pressure plates to sealing elements.

E. Grout:
1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

F. Silicone Sealants:
1. Silicone Sealant, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.

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) GE Construction Sealants; Momentive Performance Materials Inc.
2) ITW Polymers Sealants North America
3) Polymeric Systems, Inc.; PPG Industries, Inc.
4) Sherwin-Williams Company (The)
5) Sika Corporation
6) The Dow Chemical Company
7) Tremco Incorporated
b. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

2. Silicone Sealant, S, P, T, NT: Single-component, 100/50, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.
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) Pecora Corporation
2) Sika Corporation
3) The Dow Chemical Company
4) Tremco Incorporated
b. Standard: ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.

3. Silicone Foam Sealant: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
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) Smooth-On

2.5 ESCUTCHEONS

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. BrassCraft Manufacturing Co.; a Masco company
2. Dearborn Brass
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The)
5. Mid-America Fittings, LLC; A Midland Industries Company
6. ProFlo; a Ferguson Enterprises, Inc. brand

B. Escutcheon Types:
1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Stainless Steel Type: With polished stainless steel finish.
3. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

C. Floor Plates:
1. Split Floor Plates: Cast brass with concealed hinge.

2.6 METERS AND GAUGES FOR PLUMBING PIPING

A. Thermometers, Bimetallic Actuated, Lead Free:
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. Ashcroft Inc

b. Blue Ribbon Corp.
c. Ernst Flow Industries
d. Marsh Bellofram
e. Miljoco Corporation
f. Noshok
g. Palmer Wahl Instrumentation Group
h. REOTEMP Instrument Corporation
i. Tel-Tru Manufacturing Company
j. Trerice, H. O. Co
k. WATTS; A Watts Water Technologies Company
l. Weiss Instruments, Inc
m. Weksler Glass Thermometer Corp.
n. WIKA Instrument Corporation
o. Winters Instruments - U.S.

2. Source Limitations: Provide lead-free bimetallic-actuated thermometers from a single manufacturer.
3. Standard: ASME B40.200.
4. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.
5. Dial: Nonreflective aluminum with permanent scale markings and scales in deg F.
6. Connector Type(s): Union joint, adjustable angle; with ASME B1.1 or ASME B1.20.1 screw threads to fit thermowell.
7. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
8. Window: Safety glass.
9. Ring: Stainless steel.
10. Element: Bimetal coil.
11. Pointer: Dark-colored metal.
12. Accuracy: Plus or minus 1 percent of span.

B. Thermometers, Filled System, Lead Free - Direct Mounted, Metal Case, Vapor Actuated:

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. Ashcroft Inc
   b. Miljoco Corporation
   c. Palmer Wahl Instrumentation Group
   d. REOTEMP Instrument Corporation
   e. Trerice, H. O. Co
   f. Weiss Instruments, Inc
2. Source Limitations: Provide filled-system, lead-free, direct-mounted, metal-case, vapor-actuated thermometers from a single manufacturer.
3. Standard: ASME B40.200.
4. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
5. Element: Lead-free Bourdon tube.
6. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanent scale markings graduated in deg F.
8. Pointer: Dark-colored metal.
9. Window: Safety glass.
10. Ring: Metal.
11. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 or ASME B1.20.1 screw threads to fit thermowell.
12. Thermal System: Liquid-filled, mercury-free bulb in copper-plated steel, aluminum, or lead-free brass stem and of length to suit installation.
    a. Design for Thermowell Installation: Bare stem.
13. Accuracy: Plus or minus 1 percent of span.

C. Thermometers, Liquid in Glass, Lead Free - Metal Case, Compact Style:

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. Miljoco Corporation
    b. Trerice, H. O. Co
2. Source Limitations: Provide liquid-in-glass, lead-free, metal-case, compact-style thermometers by single manufacturer.
3. Standard: ASME B40.200.
4. Case: Cast aluminum; 6-inch nominal size.
5. Case Form: Back angle unless otherwise indicated.
6. Tube: Glass with magnifying lens and blue or red organic liquid; mercury free.
7. Tube Background: Nonreflective aluminum with permanent scale markings graduated in deg F.
8. Window: Glass or plastic.
9. Stem: Aluminum or lead-free brass and of length to suit installation.
    a. Design for Thermowell Installation: Bare stem.
10. Connector: 3/4 inch, with ASME B1.1 or ASME B1.20.1 screw threads to fit thermowell.
11. Accuracy: Plus or minus 1 percent of span or one scale division, to a maximum of 1.5 percent of span.

D. Thermowells, Lead Free:
1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: Lead-free copper.
4. Material for Use with Steel Piping: Type 304 stainless steel.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, or as required to match threaded opening in pipe.
7. Internal Threads: Size and thread type as required to match thermometer mounting threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length to extend to center of pipe.
10. Lagging Extension: Include on thermowells for insulated piping and tubing. Extension is to be of sufficient length to extend beyond finished insulation surface.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
12. Heat-Transfer Medium: Mixture of graphite and glycerin.

E. Pressure Gauges, Dial Type, Lead Free - Direct Mounted, Metal Case:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ametek U.S. Gauge
    b. Ashcroft Inc
    c. Blue Ribbon Corp.
    d. Ernst Flow Industries
    e. Flo Fab Inc
    f. Marsh Bellofram
    g. Miljoco Corporation
    h. Noshok
    i. Palmer Wahl Instrumentation Group
    j. REOTEMP Instrument Corporation
    k. Tel-Tru Manufacturing Company
    l. Trerice, H. O. Co
    m. WATTS; A Watts Water Technologies Company
    n. Weiss Instruments, Inc
    o. Weksler Glass Thermometer Corp.
    p. WIKA Instrument Corporation
    q. Winters Instruments - U.S.
2. Source Limitations: Provide dial-type, lead-free, direct-mounted, metal-case pressure gauges from single manufacturer.
3. Standard: ASME B40.100.

4. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
5. Pressure-Element Assembly: Lead-free Bourdon tube.
6. Pressure Connection: Lead-free brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
7. Movement: Mechanical, with link to pressure element and connection to pointer.
8. Dial: Nonreflective aluminum with permanent scale markings graduated in psi.
9. Pointer: Dark-colored metal.
10. Window: Safety glass.
11. Ring: Metal.
12. Accuracy: Grade A, plus or minus 1 percent of middle half of span.

F. Pressure Gauges, Dial Type, Lead Free - Remote Mounted, Metal Case:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ametek U.S. Gauge
   b. Ashcroft Inc
   c. Ernst Flow Industries
   d. Flo Fab Inc
   e. Marsh Bellofram
   f. Miljoco Corporation
   g. Noshok
   h. Palmer Wahl Instrumentation Group
   i. REOTEMP Instrument Corporation
   j. Tel-Tru Manufacturing Company
   k. Trerice, H. O. Co
   l. WATTS; A Watts Water Technologies Company
   m. Weiss Instruments, Inc
   n. WIKA Instrument Corporation
   o. Winters Instruments - U.S.
2. Source Limitations: Provide dial-type, lead-free, remote-mounted, metal-case pressure gauges from a single manufacturer.
3. Standard: ASME B40.100.
4. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
5. Pressure-Element Assembly: Lead-free Bourdon tube.
6. Pressure Connection: Lead-free brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 NPT pipe threads and bottom-outlet type unless back-outlet type is indicated.
7. Movement: Mechanical, with link to pressure element and connection to pointer.
8. Dial: Nonreflective aluminum with permanent scale markings graduated in psi.
9. Pointer: Dark-colored metal.
10. Window: Safety glass.
11. Ring: Metal.
12. Accuracy: Grade A, plus or minus 1 percent of middle half of span.

G. Test Plugs, Lead Free:
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. IMI Flow Design, Inc.
   b. Miljoco Corporation
   c. Nexus Valve, Inc.; Aalberts Hydronic Flow Control
   d. Peterson Equipment Co., Inc
   e. Trerice, H. O. Co
   f. WATTS; A Watts Water Technologies Company
   g. Weiss Instruments, Inc
   h. Weksler Glass Thermometer Corp.
2. Source Limitations: Provide lead-free test plugs from single manufacturer.
3. Description: Test-station fitting made for insertion into piping tee fitting.

4. Body: Lead-free brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
5. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
6. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
7. Core Inserts: EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout or silicone sealant, seal the space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section "Penetration Firestopping."

3.2 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using grout or silicone sealant, seal space around outside of sleeves. Select to maintain fire resistance of floor/slab/wall.

3.3 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
3. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
4. Using silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and

smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.5 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.6 INSTALLATION OF METERS AND GAUGES

A. Install thermometer with thermowell at each required thermometer location.

B. Install thermowells in vertical position in piping tees.

C. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

D. Install thermowells with extension on insulated piping.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

G. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks.

H. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at most readable position.

I. Install remote-mounted pressure gauges on panel.

J. Install valve and snubber in piping for each pressure gauge for fluids.

K. Install test plugs in piping tees.

L. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.
   2. Inlets and outlets of each domestic water heat exchanger.
   3. Inlet and outlet of each domestic hot-water storage tank.
   4. Outlet side of tempering valve.
   5. Each main hot-water-recirculating line return pipe.

M. Install pressure gauges in the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.

3.7 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow space for service and maintenance of meters, gauges, machines, and equipment.

3.8 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gauges to proper angle for best visibility.

3.9 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:
   1. Perform the following tests and inspections:
      a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
      b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
   2. Prepare test and inspection reports.

B. Escutcheons:
   1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.10 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls above and below Grade:
      a. Sleeves with waterstops.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   2. Concrete Slabs-on-Grade:
      a. Sleeves with waterstops.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs above Grade:
      a. Sleeves with waterstops or stack-sleeve fittings.
   4. Interior Wall and Partitions:
      a. Sleeves without waterstops.

3.11 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping and Relocated Existing Piping:
   1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
   2. Chrome-Plated Piping: One piece, steel with polished, chrome-plated finish.
   3. Insulated Piping:
      a. One piece, steel with polished, chrome-plated finish.
      b. One piece, stainless steel with polished stainless steel finish.
      c. One piece, cast brass with polished, chrome-plated finish.
      d. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
      a. One piece, steel with polished, chrome-plated finish.
      b. One piece, stainless steel with polished stainless steel finish.
      c. One piece, cast brass with polished, chrome-plated finish.
      d. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   5. Bare Piping at Ceiling Penetrations in Finished Spaces:
      a. One piece, steel with polished, chrome-plated finish.
      b. One piece, stainless steel with polished stainless steel finish.
      c. One piece, cast brass with polished, chrome-plated finish.
      d. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.

B. Install floor plates for piping penetrations of equipment-room floors.

C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. New Piping and Relocated Existing Piping: One piece, floor plate.
   2. Existing Piping: Split floor plate.

3.12 THERMOMETER, LEAD FREE, APPLICATION

A. Thermometers at inlet and outlet of each domestic water heater are to be the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Metal case, compact -style, liquid-in-glass type.

B. Thermometers at inlets and outlets of each domestic water heat exchanger are to be the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Metal case, compact -style, liquid-in-glass type.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank are to be the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. metal -case, vapor-actuated type.
   3. Metal case, compact -style, liquid-in-glass type.

D. Thermometers at inlet and outlet of each remote domestic water chiller are to be the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Remote-mounted, metal -case, vapor-actuated type.
   3. Metal case, compact -style, liquid-in-glass type.

E. Thermometer stems are to be of length to match thermowell insertion length.

F. Utilize remote mounted option where direct mounting will not be easily readable from floor.

3.13 THERMOMETER, LEAD FREE, SCALE-RANGE APPLICATION

A. Scale Range for Domestic Cold-Water Piping:
   1. 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping:
   1. 0 to 250 deg F.

C. Scale Range for Domestic Cooled-Water Piping:
   1. 0 to 100 deg F.

3.14 PRESSURE-GAUGE APPLICATION

A. Pressure gauges at discharge of each water service into building are to be the following:
   1. Liquid filled, direct or remote mounted, metal case.

B. Pressure gauges at inlet and outlet of each water pressure-reducing valve are to be the following:
   1. Liquid filled, direct or remote mounted, metal case.

C. Pressure gauges at suction and discharge of each domestic water pump are to be the following:
   1. Liquid filled, direct or remote mounted, metal case.

3.15 PRESSURE-GAUGE SCALE-RANGE APPLICATION

A. Scale Range for Water Service Piping:
   1. 0 to 100 psi.

B. Scale Range for Domestic Water Piping:
   1. 0 to 100 psi.

END OF SECTION 220500

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SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.
   4. Gate valves.
   5. Chainwheels.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer.

C. FKM: Fluoroelastomer.

D. NBR: Nitrile butadiene rubber (also known as Buna-N).

E. NRS: Nonrising stem.

F. OS&Y: Outside screw and yoke.

G. PTFE: Polytetrafluoroethylene.

H. RPTFE: Reinforced polytetrafluoroethylene.

I. RS: Rising stem.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. For each type of product.
      a. Include material descriptions and dimensions of individual components.
      b. Include operating characteristics and furnished accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooved ends, press ends, solder ends, and weld ends.
   3. Set ball valves open to minimize exposure of functional surfaces.
   4. Set butterfly valves closed or slightly open.
   5. Block check valves in either closed or open position.
   6. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single source from single 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:
   2. [American Valve, Inc]
   3. [Apollo Valves; a part of Aalberts Integrated Piping Systems]
   4. [Bonomi North America, Inc.]
   5. [Crane Fluid Systems; Crane Co.]
   6. [Hammond Valve]
   7. [Jenkins Valves; a Crane Co. brand]
   8. [Jomar Valve]
   9. [KITZ Corporation]
   10. [Lance Valves]
   11. [Milwaukee Valve Company]
   12. NIBCO
   13. [Stockham; a Crane Co. brand]
   14. [Viega LLC]
   15. [WATTS; A Watts Water Technologies Company]

2.2 PERFORMANCE REQUIREMENTS

A. Standards:
   1. Domestic-water piping valves intended to convey or dispense water for human consumption must comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372; or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded-end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on steel valves.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   5. ASME B16.18 for cast-copper solder-joint connections.
   6. ASME B16.22 for wrought-copper solder-joint connections.
   7. ASME B16.34 for flanged- and threaded-end connections.
   8. ASME B16.51 for press joint connections.
   9. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

H. Valve Actuator Type:
   1. Gear Actuator: For quarter-turn ball valves NPS 4 and larger.
   2. Hand Lever: For quarter-turn ball valves smaller than NPS 4.

I. Valves in Insulated Piping:
   1. Provide 2-inch extended neck stems.

2. Provide extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Provide memory stops that are fully adjustable after insulation is applied.

2.3 BALL VALVES, LEAD FREE

A. Ball Valves, Lead Free, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Brass Trim:
1. Standards: MSS SP-110 and MSS SP-145.
2. CWP Rating: 600 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass.
5. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
6. Seats: PTFE.
7. Stem: Brass.
8. Ball: Chrome-plated brass.
9. Port: Full.

B. Ball Valves, Lead Free, Press Ends - Brass, Two Piece with Full Port and Brass Trim:
1. Standards: MSS SP-110, MSS SP-145, IAPMO/ANSI Z1157.
2. CWP Rating: Minimum 200 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass.
5. Ends: Press.
6. Press-End Connections Rating: Minimum 200 psig.
7. Seats: PTFE or RPTFE.
8. Stem: Brass.
9. Ball: Chrome-plated brass.
10. Port: Full.
11. O-Ring Seal: NBR or EPDM.

C. Ball Valves, Lead Free, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Stainless Steel Trim:
1. Standards: MSS SP-110 and MSS SP-145.
2. CWP Rating: 600 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass.
5. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.
9. Port: Full.

D. Ball Valves, Lead Free, Press Ends - Brass, Two Piece with Full Port and Stainless Steel Trim:
1. Standards: MSS SP-110, MSS SP-145, and IAPMO/ANSI Z1157.
2. CWP Rating: Minimum 200 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass.
5. Ends: Press.
6. Press-End Connections Rating: Minimum 200 psig.
7. Seats: PTFE or RPTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel, vented.
10. Port: Full.
11. O-Ring Seal: NBR or EPDM.

E. Ball Valves, Lead Free, Threaded or Soldered Ends - Bronze, Two Piece with Full Port and Bronze or Brass Trim:
1. Standards: MSS SP-110 and MSS SP-145.

2. CWP Rating: 600 psig.
3. Body Design: Two piece.
4. Body Material: Bronze.
5. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
6. Seats: PTFE.
7. Stem: Bronze or brass.
8. Ball: Chrome-plated brass.
9. Port: Full.

F. Ball Valves, Lead Free, Press Ends - Bronze, Two Piece with Full Port and Bronze or Brass Trim:
1. Standards: MSS SP-110, MSS SP-145, and IAPMO/ANSI Z1157.
2. CWP Rating: Minimum 200 psig.
3. Body Design: Two piece.
4. Body Material: Bronze.
5. Ends: Press.
6. Press-End Connections Rating: Minimum 200 psig.
7. Seats: PTFE or RTPFE.
8. Stem: Bronze or brass.
9. Ball: Chrome-plated brass.
10. Port: Full.
11. O-Ring Seal: EPDM or NBR.

G. Ball Valves, Lead Free, Threaded or Soldered Ends - Bronze, Two Piece with Full Port and Stainless Steel Trim:
1. Standards: MSS SP-110 and MSS SP-145.
2. CWP Rating: 600 psig.
3. Body Design: Two piece.
4. Body Material: Bronze.
5. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.
9. Port: Full.

2.4 BALL VALVES, GENERAL PURPOSE

A. Ball Valves, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Brass Trim:
1. Standard: MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body Design: Two piece.
5. Body Material: Forged brass.
6. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
7. Seats: PTFE.
8. Stem: Brass.
9. Ball: Chrome-plated brass.
10. Port: Full.

B. Ball Valves, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Stainless Steel Trim:
1. Standard: MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body Design: Two piece.
5. Body Material: Forged brass.
6. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel, vented.

10. Port: Full.

C. Ball Valves, Threaded Ends - Bronze, Two Piece, Safety Exhaust:
1. Standards: MSS SP-110 and MSS SP-145.
2. CWP Rating: 200 psig or other pressure. See Part 3 ball valve schedule articles.
3. Body Design: Two piece.
4. Body Material: Bronze, ASTM B584, Alloy C844.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Chrome-plated brass, with exhaust vent opening for pneumatic applications.
9. Port: Full.

D. Ball Valves, Threaded or Flanged Ends - Stainless Steel, Two Piece with Full Port:
1. Standard: MSS SP-110.
2. CWP Rating: 200 psig.
3. Body Design: Split body.
4. Body Material: Type 316 stainless steel.
5. Ends: Threaded or flanged. See Part 3 ball valve schedule articles.
6. Seats: PTFE.
7. Stem: Type 316 stainless steel.
8. Ball: Type 316 stainless steel.
9. Port: Full.

2.5 BUTTERFLY VALVES, LEAD FREE

A. Butterfly Valves, Lead Free, Single Flange (Lug Type) - Iron, with Aluminum-Bronze Disc:
1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig, or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Aluminum bronze.

B. Butterfly Valves, Lead Free, Single Flange (Lug Type) - Iron, with Ductile-Iron Disc:
1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig, or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Nickel-plated[**or -coated**] ductile iron.

C. Butterfly Valves, Lead Free, Single Flange (Lug Type) - Iron, with Stainless Steel Disc:
1. Standard: MSS SP-67, Type I.
2. CWP Rating, NPS 12 (DN 300) and Smaller: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Stainless steel.

D. Butterfly Valves, Lead Free, Flangeless (Wafer Type) - Iron, with Aluminum-Bronze Disc:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Aluminum bronze.

E. Butterfly Valves, Lead Free, Flangeless (Wafer Type) - Iron, with Ductile-Iron Disc:
1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Nickel-plated[**or -coated**] ductile iron.

F. Butterfly Valves, Lead Free, Flangeless (Wafer Type) - Iron, with Stainless Steel Disc:
1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Stainless steel.

2.6 BUTTERFLY VALVES, GENERAL PURPOSE

A. Butterfly Valves, Single Flange (Lug Type) - Iron, with Aluminum-Bronze Disc:
1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: NBR.
6. Stem: One- or two-piece stainless steel.
7. Disc: Aluminum bronze.

B. Butterfly Valves, Single Flange (Lug Type) - Iron, with Ductile-Iron Disc:
1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: NBR.
6. Stem: One- or two-piece stainless steel.
7. Disc: Nickel-plated[**or -coated**] ductile iron.

C. Butterfly Valves, Single Flange (Lug Type) - Iron, with Stainless Steel Disc:
1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: NBR.
6. Stem: One- or two-piece stainless steel.
7. Disc: Stainless steel.

D. Butterfly Valves, Flangeless (Wafer Type) - Iron, with Aluminum-Bronze Disc:
   1. Standard: MSS SP-67, Type I.
   2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
   3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
   4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
   5. Seat: NBR.
   6. Stem: One- or two-piece stainless steel.
   7. Disc: Aluminum bronze.

E. Butterfly Valves, Flangeless (Wafer Type) - Iron, with Ductile-Iron Disc:
   1. Standard: MSS SP-67, Type I.
   2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
   3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
   4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
   5. Seat: NBR.
   6. Stem: One- or two-piece stainless steel.
   7. Disc: Nickel-plated[**or -coated**] ductile iron.

F. Butterfly Valves, Flangeless (Wafer Type) - Iron, with Stainless Steel Disc:
   1. Standard: MSS SP-67, Type I.
   2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
   3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
   4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
   5. Seat: NBR.
   6. Stem: One- or two-piece stainless steel.
   7. Disc: Stainless steel.

2.7 CHECK VALVES, LEAD FREE

A. Check Valves, Lead Free, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 125:
   1. Standard: MSS SP-80, Type 3.
   2. CWP Rating: 200 psig.
   3. Body Design: Horizontal flow.
   4. Body Material: ASTM B62, bronze.
   5. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
   6. Disc: Bronze.

B. Check Valves, Lead Free, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 150:
   1. Standard: MSS SP-80, Type 3.
   2. CWP Rating: 300 psig.
   3. Body Design: Horizontal flow.
   4. Body Material: ASTM B62, bronze.
   5. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
   6. Disc: Bronze.

C. Check Valves, Lead Free, Swing Type, Press Ends - Bronze:
   1. Standards: MSS SP-80 and MSS SP-139.
   2. CWP Rating: Minimum 200 psig.
   3. Body Design: Horizontal flow.
   4. Body Material: ASTM B584, bronze.
   5. Ends: Press.
   6. Press-End Connections Rating: Minimum 200 psig.
   7. Disc: Brass or bronze.

D. Check Valves, Lead Free, Swing Type, Flanged or Threaded Ends - Iron, with Metal Seats, Class 125:
   1. Standard: MSS SP-71, Type I.

2. CWP Rating: **200 psig**.
3. Body Design: Clear or full waterway.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged or threaded. See Part 3 check valve schedule articles.
6. Trim: Bronze.
7. Gasket: Asbestos free.

2.8 CHECK VALVES, GENERAL PURPOSE

A. Check Valves, Lift Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 125:
1. Standard: MSS SP-80, Type 1.
2. CWP Rating: 200 psig.
3. Body Design: Vertical flow.
4. Body Material: ASTM B61 or ASTM B62, bronze.
5. Ends: Threaded or soldered ends. See Part 3 check valve schedule articles.
6. Disc: Bronze.

B. Check Valves, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 125:
1. Standard: MSS SP-80, Type 3.
2. CWP Rating: 200 psig.
3. Body Design: Horizontal flow.
4. Body Material: ASTM B62, bronze.
5. Ends: Threaded or soldered ends. See Part 3 check valve schedule articles.
6. Disc: Bronze.

C. Check Valves, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 150:
1. Standard: MSS SP-80, Type 3.
2. CWP Rating: 300 psig.
3. Body Design: Horizontal flow.
4. Body Material: ASTM B62, bronze.
5. Ends: Threaded or soldered ends. See Part 3 check valve schedule articles.
6. Disc: Bronze.

2.9 GATE VALVES, LEAD FREE

A. Gate Valves, Lead Free, Threaded or Soldered Ends - Bronze, NRS, Class 125:
1. Standard: MSS SP-80, Type 1.
2. CWP Rating: 200 psig.
3. Body Material: Bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint. See Part 3 gate valve schedule articles.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron[**, bronze, or aluminum**].

B. Gate Valves, Lead Free, Threaded or Soldered Ends - Bronze, RS, Class 125:
1. Standard: MSS SP-80, Type 2.
2. CWP Rating: 200 psig.
3. Body Material: Bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint. See Part 3 gate valve schedule articles.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

C. Gate Valves, Lead Free, Threaded Ends - Bronze, NRS, Class 150:
1. Standard: MSS SP-80, Type 1.
2. CWP Rating: 300 psig.
3. Body Material: Bronze with integral seat and union-ring bonnet.

4. Ends: Threaded.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron[**, bronze, or aluminum**].

D. Gate Valves, Lead Free, Threaded Ends - Bronze, RS, Class 150:
1. Standard: MSS SP-80, Type 2.
2. CWP Rating: 300 psig.
3. Body Material: Bronze with integral seat and union-ring bonnet.
4. Ends: Threaded.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron[**, bronze, or aluminum**].

E. Gate Valves, Lead Free, Press Ends - Bronze:
1. Standards: MSS SP-80 and MSS SP-139.
2. CWP Rating: Minimum 200 psig.
3. Body Material: Bronze with integral seat and union-ring bonnet.
4. Ends: Press.
5. Press Ends Connection Rating: Minimum 200 psig.
6. Stem: Brass or bronze, RS or NRS. See Part 3 gate valve schedule articles.
7. Disc: Solid wedge, bronze.
8. Packing: Graphite.
9. Port: Full.
10. Handwheel: Malleable iron, bronze, or aluminum.

F. Gate Valves, Lead Free, Flanged Ends - Iron, NRS, Class 125:
1. Standard: MSS SP-70, Type I.
2. CWP Rating: 200 psig.
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

G. Gate Valves, Lead Free, Flanged Ends - Iron, OS&Y, Class 125:
1. Standard: MSS SP-70, Type I.
2. CWP Rating: 200 psig.
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flange.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

H. Gate Valves, Lead Free, Flanged Ends - Iron, NRS, Class 250:
1. Standard: MSS SP-70, Type I.
2. CWP Rating: 500 psig.
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flange.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

2.10 GATE VALVES, GENERAL PURPOSE

A. Gate Valves, Threaded or Soldered Ends - Bronze, NRS, Class 125:

1. Standard: MSS SP-80, Type 1.
2. CWP Rating: 200 psig.
3. Body Material: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or soldered joint. See Part 3 gate valve schedule articles.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron[**, bronze, or aluminum**].

B. Gate Valves, Threaded or Soldered Ends - Bronze, RS, Class 125:
1. Standard: MSS SP-80, Type 2.
2. CWP Rating: 200 psig.
3. Body Material: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or soldered joint. See Part 3 gate valve schedule articles.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

C. Gate Valves, Threaded Ends - Bronze, NRS, Class 150:
1. Standard: MSS SP-80, Type 1.
2. CWP Rating: 300 psig.
3. Body Material: ASTM B62, bronze with integral seat and union-ring bonnet.
4. Ends: Threaded.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron[**, bronze, or aluminum**].

D. Gate Valves, Threaded Ends - Bronze, RS, Class 150:
1. Standard: MSS SP-80, Type 2.
2. CWP Rating: 300 psig.
3. Body Material: ASTM B62, bronze with integral seat and union-ring bonnet.
4. Ends: Threaded.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron[**, bronze, or aluminum**].

E. Gate Valves, Flanged Ends - Iron, NRS, Class 125:
1. Standard: MSS SP-70, Type I.
2. CWP Rating, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 psig.
3. CWP Rating, NPS 14 to NPS 24 (DN 350 to DN 600): 150 psig.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Disc: Solid wedge.
8. Packing and Gasket: Asbestos free.

F. Gate Valves, Flanged Ends - Iron, OS&Y, Class 125:
1. Standard: MSS SP-70, Type I.
2. CWP Rating, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 psig.
3. CWP Rating, NPS 14 to NPS 24 (DN 350 to DN 600): 150 psig.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Disc: Solid wedge.
8. Packing and Gasket: Asbestos free.

G. Gate Valves, Flanged Ends - Iron, NRS, Class 250:
   1. Standard: MSS SP-70, Type I.
   2. CWP Rating, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 500 psig.
   3. CWP Rating, NPS 14 to NPS 24 (DN 350 to DN 600): 300 psig.
   4. Body Material: ASTM A126, gray iron with bolted bonnet.
   5. Ends: Flanged.
   6. Trim: Bronze.
   7. Disc: Solid wedge.
   8. Packing and Gasket: Asbestos free.

H. Gate Valves, Flanged Ends - Iron, OS&Y, Class 250:
   1. Standard: MSS SP-70, Type I.
   2. CWP Rating, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 500 psig.
   3. CWP Rating, NPS 14 to NPS 24 (DN 350 to DN 600): 300 psig.
   4. Body Material: ASTM A126, gray iron with bolted bonnet.
   5. Ends: Flanged.
   6. Trim: Bronze.
   7. Disc: Solid wedge.
   8. Packing and Gasket: Asbestos free.

2.11 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
   1. [**Babbitt Steam Specialty Co**]
   2. [**Roto Hammer Industries; Rotork**]
   3. [**Trumbull Industries**]
   4. <**Insert manufacturer's name**>

B. Description: Valve actuation assembly with sprocket rim, chain guides, chain[**, and attachment brackets for mounting chainwheels directly to handwheels**].
   1. Sprocket Rim with Chain Guides: [**Ductile iron**][**Ductile or cast iron**][**Cast iron**][**Aluminum**][**Bronze**], of type and size required for valve.[**Include zinc or epoxy coating.**]
   2. Chain: [**Hot-dip, galvanized steel**][**Brass**][**Stainless steel**], of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Examine press fittings to verify they have been properly pressed.

F. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide support of piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position that does not project into aisles or block access to other equipment.

F. Install valves in position to allow full stem and actuator or manual operator movement.

G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.

H. Chainwheels: Install chainwheels on manual operators for butterfly globe and gate valves Insert pipe size and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

I. Install check valves for proper direction of flow and as follows:
   1. Check Valves: plate type, in horizontal or vertical position, between flanges.
   2. Check Valves, Swing Type: In horizontal position with hinge pin level.

J. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

K. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's written recommended maximum.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:
   1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
   3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
   4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
   5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
   6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
   7. For Grooved-End Copper Tubing: Valve ends may be grooved.
   8. For Grooved-End Steel Piping: Valve ends may be grooved.
   9. Wafer-Type Valves: Flanged connections.

3.5 LOW-PRESSURE, COMPRESSED-AIR BALL VALVE SCHEDULE - 150 PSIG (1035 kPa) OR LESS

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Ball valves, threaded ends - bronze, two piece, safety exhaust; 200 psig.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Ball valves, flanged ends - steel, with full port and stainless steel trim, Class 300.
   2. Ball valves, flanged ends - iron, Class 125.
   3. Ball valves, threaded or flanged ends - stainless steel, two piece with full port; [**threaded**][**flanged**] ends.

3.6 DOMESTIC HOT- AND COLD-WATER BALL VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Ball valves, lead free, threaded or soldered ends - bronze, two piece with full port and bronze or brass trim.
   2. Ball valves, lead free, press ends - brass, two piece with full port and brass trim.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Ball valves, lead free, flanged or threaded ends - iron, Class 125.

3.7 DOMESTIC HOT- AND COLD-WATER BUTTERFLY VALVE SCHEDULE

A. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Butterfly valves, lead free, single flange (lug type) - iron, with aluminum-bronze disc; 150 CWP, EPDM seat.
   2. Butterfly valves, lead free, flangeless (wafer type) - iron, with aluminum-bronze disc; 150 CWP, EPDM seat.

3.8 DOMESTIC HOT- AND COLD-WATER CHECK VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125.
   2. Check valves, lead free, swing type, press ends - bronze.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Check valves, lead free, swing type, flanged or threaded ends - iron, with metal seats, Class 125.
   2. Check valves, lead free, center guided - iron, globe, with metal seat, Class 125.

3.9 PUMP-DISCHARGE CHECK VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125.

B. Pipe NPS 2-1/2 (DN 65) and Larger for Domestic Water Pumps:
   1. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever- and spring-closure control, Class 125.
   2. Check valves, lead free, center guided - iron, globe, with metal seat, Class 125.

3.10 DOMESTIC HOT- AND COLD-WATER GATE VALVE SCHEDULE

A. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Gate valves, lead free, flanged ends - iron, NRS, Class 125.
   2. Gate valves, lead free, flanged ends - iron, OS&Y, Class 125.

END OF SECTION 220523

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SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports - metal.
2. Pipe hangers - metal, trapeze type.
3. Strut support system - metal, rod type.
4. Strut support system - metal, cable type.
5. Thermal hanger shield inserts.
6. Fastener systems.
7. Pipe-positioning systems.
8. Equipment supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Trapeze pipe hangers.
2. Metal strut support systems.
3. Rooftop-mounted strut support systems.
4. Pipe stands.
5. Equipment supports.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment are to withstand the effects of gravity loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 PIPE HANGERS AND SUPPORTS - METAL

A. Pipe Hangers and Supports - Carbon Steel:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Anvil; an ASC Engineered Solution
b. Cooper B-line; brand of Eaton, Electrical Sector
c. FNW; Ferguson Enterprises, Inc.
2. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

3. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
4. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
5. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Pipe Hangers and Supports - Stainless Steel:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anvil; an ASC Engineered Solution
   b. Cooper B-line; brand of Eaton, Electrical Sector
   c. FNW; Ferguson Enterprises, Inc.
   d. Rocket Rack; Robroy Industries
   e. <**Insert manufacturer's name**>
2. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
3. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Pipe/Tube Hangers and Supports - Copper:
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. Anvil; an ASC Engineered Solution
   b. Cooper B-line; brand of Eaton, Electrical Sector
   c. FNW; Ferguson Enterprises, Inc.
2. Description: MSS SP-58, Types 1 through 58, copper-plated-steel, factory-fabricated components.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of [**copper-plated steel**][**stainless steel**]<**Insert material**>.

2.3 PIPE HANGERS - METAL, TRAPEZE TYPE

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 STRUT SUPPORT SYSTEMS - METAL

A. Strut Support System - Metal, Rod Type:
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. ABB Electrification Installations Products
   b. Anvil; an ASC Engineered Solution
   c. Atkore Unistrut
   d. CADDY; brand of nVent Electrical plc
   e. Carpenter & Paterson, Inc
   f. Cooper B-line; brand of Eaton, Electrical Sector
   g. Empire Industries, Inc.
   h. Flex-Strut Inc.
   i. G-Strut
   j. Haydon Corporation
   k. PHD Manufacturing, Inc
   l. Rocket Rack; Robroy Industries
   m. Wesanco/ZSi-Foster; an Ideal Tridon Group Company
2. Description: Factory-fabricated pipe-support assembly, made of steel channels, vertical metal support rods, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Struts: Continuous slotted carbon-steel channel with inturned lips.
5. Strut Width: Selected for applicable load criteria.

6. Strut Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
8. Metallic Coating: Gold (yellow zinc dichromate) galvanized.
9. Paint Coating: Green epoxy, acrylic, or urethane.

B. Strut Support System - Metal, Cable Type:
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. Gripple Inc.
2. Description: Factory-fabricated pipe-support system, consisting of cable pipe clamps and associated vibration isolation rubber pads, slotted channel brackets, wire rope suspension components, and associated accessories for a complete piping suspension system; no tools required for manual assembly in the field to support multiple parallel pipe routing.
3. Standards:
   a. ICC-ES PMG Product Certificate.
   b. Brackets: Fire-rated, tested to F120 in accordance with BS EN 1363-1:2020.
4. Components:
   a. Pipe Clamps: Size-adjustable standard clamps with rubber pad, 14 dBa noise reduction; with sleeve to prevent galvanic corrosion.
   b. Brackets: Slotted channels furnished in pre-cut lengths to suit specific system application for Project.
   c. Suspension Components: Hanging cables with adjustable fastener; can be pre-installed on the brackets using pre-fitted washer/nuts or retention clips.
      1) Wire Rope: High tensile steel wire rope, complying with ASTM A1023/A1023M, ASTM A641/A641M Class A zinc coating; 7 by 7 and 7 by 19 cross-sectional construction; having a tensile strength of 256,000 psi; lengths, diameters, and wire construction to accommodate design loads.
         a) Locking screw/release button.
         b) Foot attachment type to suit application.
         c) End Fix Type: Loop , strap hook , eyelet or as required to suit application.
   d. Adjustable Fastener: Mild steel (type EN1A), bright zinc plated, one-channel body; encasing a series of Type 302 stainless steel springs with serrated self-locking Grade 40 chrome steel balls, adjustable by means of an integrated mechanism, capable of accommodating load as required.

2.5 THERMAL HANGER SHIELD INSERTS

A. Thermal Hanger Shield Inserts:
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. Aeroflex USA
   b. Buckaroos, Inc.
   c. Carpenter & Paterson, Inc
   d. KB Enterprise
   e. National Pipe Hanger Corporation
   f. Pipe Shields Inc.
   g. Piping Technology & Products, Inc
   h. Rilco Manufacturing Co., Inc
   i. Value Engineered Products, Inc
2. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100 psig minimum compressive strength and vapor barrier.
3. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100 psig minimum compressive strength.
4. For Trapeze or Clamped Systems: Insert and shield are to cover entire circumference of pipe.
5. For Clevis or Band Hangers: Insert and shield are to cover bottom 180 degrees of pipe.

6. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Fastener System - Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities required for supported loads and building materials where used.
   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. Cooper B-line; brand of Eaton, Electrical Sector
      b. Empire Industries, Inc.
      c. Hilti, Inc.
      d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
      e. MKT Fastening, LLC
   2. Indoor Applications: Zinc-plated or stainless steel.
   3. Outdoor Applications: Stainless steel.

2.7 PIPE-POSITIONING SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Holdrite; a division of Reliance Worldwide Corporation

B. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.9 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000 psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination is to include weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. 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.

B. Install lateral bracing with pipe hangers and supports to prevent swaying.

C. 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. Coordinate location of concrete inserts before concrete is placed.

D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

F. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Thermal hanger shield inserts may be used as an option. 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 are to span an arc of 180 degrees.
      a. Thermal hanger shield inserts may be used as an option. 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 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
      b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
      c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.
      d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
      e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.
   5. Pipes NPS 8 (DN 200) and Larger: Include calcium-silicate-insulation inserts of length at least as long as protective shield.

G. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

H. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
   2. Field fabricate in accordance with ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel in accordance with AWS D1.1/D1.1M.

I. FRP Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

J. Strut System Installation: Metal, rod type; arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.

K. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

L. Fastener System Installation:
   1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners in accordance with manufacturer's written instructions.
   2. Install lag screw wood fasteners in accordance with manufacturer's written instructions.
   3. Install fasteners in accordance with manufacturer's written instructions.

M. Pipe Stand Installation:
   1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

N. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

O. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

P. Equipment Support Installation:
   1. Fabricate from welded-structural-steel shapes.
   2. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
   3. Grouting: Place grout under supports for floor-mounted equipment, and make bearing surface smooth.
   4. Provide lateral bracing, to prevent swaying.

3.3 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.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 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.

3.5 PAINTING

A. Touchup:
   1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
      a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
   2. Comply with requirements in Painting Section(s) for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
   3. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless steel pipe hangers and stainless steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
   11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
   12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
   16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
   17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

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SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Warning tape.
   4. Pipe labels.
   5. Stencils.
   6. Valve tags.
   7. Warning tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brady Corporation
      b. Carlton Industries, LP
      c. Champion America
      d. Craftmark Pipe Markers
      e. emedco
      f. Kolbi Pipe Marker Co.
      g. LEM Products Inc.
      h. Marking Services Inc.
      i. Pipemarker.com; Brimar Industries, Inc.
      j. Seton Identification Products; a Brady Corporation company
   2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch anodized aluminum, 0.032-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
   3. Letter and Background Color: As indicated for specific application under Part 3.
   4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   6. Fasteners: Stainless steel rivets or self-tapping screws.
   7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Brady Corporation
    b. Carlton Industries, LP
    c. Champion America
    d. Craftmark Pipe Markers
    e. emedco
    f. Kolbi Pipe Marker Co.
    g. LEM Products Inc.
    h. Marking Services Inc.
    i. Pipemarker.com; Brimar Industries, Inc.
    j. Seton Identification Products; a Brady Corporation company
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number. Coordinate with Owner prior to ordering.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Brady Corporation
2. Carlton Industries, LP
3. Champion America
4. Craftmark Pipe Markers
5. emedco
6. LEM Products Inc.
7. Marking Services Inc.
8. National Marker Company
9. Pipemarker.com; Brimar Industries, Inc.
10. Seton Identification Products; a Brady Corporation company
11. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures of 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 of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 WARNING TAPE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Brady Corporation
2. Craftmark Pipe Markers
3. National Marker Company
4. Pipemarker.com; Brimar Industries, Inc.
5. Seton Identification Products; a Brady Corporation company

B. Material: Vinyl.

C. Minimum Thickness: 0.005 inch.

D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.

E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.

F. Maximum Temperature: 160 deg F.

G. Minimum Width: 2 inches.

2.4 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation
3. Carlton Industries, LP
4. Champion America
5. Craftmark Pipe Markers
6. emedco
7. Kolbi Pipe Marker Co.
8. LEM Products Inc.
9. Marking Services Inc.
10. Pipemarker.com; Brimar Industries, Inc.
11. Seton Identification Products; a Brady Corporation company

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on[**main**] distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.5 STENCILS

A. Stencils for Piping:
   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. Craftmark Pipe Markers
      b. Kolbi Pipe Marker Co.
      c. Marking Services Inc.
      d. Pipemarker.com; Brimar Industries, Inc.
   2. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
   3. Stencil Material: Aluminum, brass, or fiberboard.
   4. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
   5. Identification Paint: Exterior, alkyd enamel in colors in accordance with ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
   6. Letter and Background Color: As indicated for specific application under Part 3.

2.6 VALVE TAGS

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. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
   2. Brady Corporation
   3. Carlton Industries, LP
   4. Champion America
   5. Craftmark Pipe Markers
   6. emedco
   7. Kolbi Pipe Marker Co.
   8. LEM Products Inc.
   9. Marking Services Inc.
   10. Pipemarker.com; Brimar Industries, Inc.
   11. Seton Identification Products; a Brady Corporation company

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.04-inch stainless steel, 0.024-inch aluminum, 0.031-inch or anodized aluminum, 0.031-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass link chain or S-hook.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Include valve-tag schedule in operation and maintenance data.

2.7 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Brady Corporation
   2. Champion America
   3. Craftmark Pipe Markers
   4. emedco
   5. Kolbi Pipe Marker Co.
   6. LEM Products Inc.

7. Marking Services Inc.
8. Pipemarker.com; Brimar Industries, Inc.
9. Seton Identification Products; a Brady Corporation company

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of plumbing equipment.

B. Sign and Label Colors.
1. White letters on an ANSI Z535.1 safety-green background.

C. Locate equipment labels where accessible and visible.

D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where are-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

3.4 INSTALLATION OF WARNING TAPE

A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.

B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.

C. Locate tape so as to be readily visible from the point of normal approach.

3.5 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Stenciled Pipe Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Within 3 ft. of each valve and control device.
   2. At access doors, manholes, and similar access points that permit view of concealed piping.
   3. Within 3 ft. of equipment items and other points of origination and termination.
   4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.

D. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

E. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

F. Pipe-Label Color Schedule:
   1. Low-Pressure Compressed-Air Piping: White letters on an ANSI Z535.1 safety-blue background.
   2. Domestic Cold-Water Piping: White letters on an ANSI Z535.1 safety-green background.
   3. Domestic Hot-Water Piping: White letters on an ANSI Z535.1 safety-green background
   4. Domestic Hot-Water Return Piping White letters on an ANSI Z535.1 safety-green background.
   5. Sanitary Waste and Storm DrainagePiping: White letters on a black background.

3.6 INSTALLATION OF VALVE TAGS

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 in the operating and maintenance manual.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
   1. Valve-Tag Size and Shape:
      a. Domestic Cold Water: 1-1/2 inches, round.
      b. Domestic Hot Water: 1-1/2 inches, round.
      c. Domestic Hot-Water Return: 1-1/2 inches, round.
      d. Low-Pressure Compressed Air: 1-1/2 inches, round.
   2. Valve-Tag Colors:
      a. For each piping system, use the same lettering and background coloring system on valve tags as used in the piping system labels and background.

3.7 INSTALLATION OF WARNING TAGS

A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.

B. Attach warning tags, with proper message, to equipment and other items where indicated on Drawings.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic cold-water piping.
   2. Domestic hot-water piping.
   3. Domestic recirculating hot-water piping.
   4. Domestic chilled-water piping for drinking fountains.
   5. Sanitary waste piping exposed to freezing conditions.
   6. Storm-water piping exposed to freezing conditions.
   7. Roof drains and rainwater leaders.
   8. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 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. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size, as well as ASTM standard designation and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. All Insulation Installed Indoors; Outdoors-Installed Insulation in Contact with Airstream: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   3. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
   1. 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. Owens Corning
   2. Preformed Pipe Insulation, Type II, Class 1: Unfaced.
   3. Preformed Pipe Insulation, Type II, Class 2: With factory-applied ASJ jacket.
   4. Fabricated shapes in accordance with ASTM C450, ASTM C585, and ASTM C1639.
   5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I for tubular materials.
   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. Aeroflex USA
b. Armacell LLC
c. K-Flex USA

H. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
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. Johns Manville; a Berkshire Hathaway company
b. Knauf Insulation
c. Manson Insulation Inc.
d. Owens Corning
2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral Wool, Preformed Pipe: Mandrel-wound mineral wool fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1200 deg F in accordance with ASTM C447. Comply with ASTM C547.
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. Johns Manville; a Berkshire Hathaway company
b. Owens Corning
c. ROCKWOOL
2. Preformed Pipe Insulation: Type II, Grade A with factory-applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

2.3 INSULATING CEMENTS

A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

C. Glass-Fiber and Mineral Wool Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

C. Flexible Elastomeric Adhesive: Solvent-based adhesive.
1. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
2. Wet Flash Point: Below 0 deg F.
3. Service Temperature Range: 40 to 200 deg F.
4. Color: Black.

D. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.5 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
   1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
   2. Service Temperature Range: 0 to plus 180 deg F.
   3. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
   1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
   2. Service Temperature Range: 0 to 180 deg F.
   3. Color: White.

D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.
   1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
   2. Service Temperature Range: Minus 50 to plus 220 deg F.
   3. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
   1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
   2. Service Temperature Range: 0 to plus 180 deg F.
   3. Color: White.

2.6 LAGGING ADHESIVES

A. Lagging Adhesives: Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.
   1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
   2. Service Temperature Range: 0 to plus 180 deg F.
   3. Color: White.

2.7 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:
   1. Permanently flexible, elastomeric sealant.
   2. Service Temperature Range: Minus 58 to plus 176 deg F.
   3. Color: White or gray.

C. FSK and Metal Jacket Flashing Sealants:
   1. Fire- and water-resistant, flexible, elastomeric sealant.
   2. Service Temperature Range: Minus 40 to plus 250 deg F.
   3. Color: Aluminum.

D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
   1. Fire- and water-resistant, flexible, elastomeric sealant.
   2. Service Temperature Range: Minus 40 to plus 250 deg F.
   3. Color: White.

2.8 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 C1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. ASJ+: Aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM C1136 Types I, II, III, IV, and VII.
5. PSK Jacket: Aluminum foil fiberglass reinforced scrim with polyethylene backing, complying with ASTM C1136, Type II.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. 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. Airex Manufacturing Inc.
    b. Johns Manville; a Berkshire Hathaway company
    c. P.I.C. Plastics, Inc.
    d. Proto Corporation
    e. Speedline Corporation
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.

D. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    a. Factory cut and rolled to size.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    e. Factory-Fabricated Fitting Covers:
        1) Same material, finish, and thickness as jacket.
        2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
2. Stainless Steel Jacket: ASTM A240/A240M.
    a. Factory cut and rolled to size.
    b. Material, finish, and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    e. Factory-Fabricated Fitting Covers:
        1) Same material, finish, and thickness as jacket.
        2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.

3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
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. Owens Corning
b. Polyguard Products, Inc.

F. Self-Adhesive Outdoor Jacket (Asphaltic): 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.
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. MFM Building Products Corp.
b. Polyguard Products, Inc.

G. Self-Adhesive Indoor/Outdoor Jacket (Non-Asphaltic): Vapor barrier and waterproofing jacket for installation over insulation located aboveground outdoors or indoors. Specialized jacket with five layers of laminated aluminum and polyester film with low-temperature acrylic pressure-sensitive adhesive. Outer aluminum surface is coated with UV-resistant coating for protection from environmental contaminants.
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
b. Foster Brand; H. B. Fuller
c. Ideal Tape Co., Inc., an American Biltrite Company
2. Permeance: 0.00 perm as tested in accordance with ASTM F1249.
3. Flamespread/Smoke Developed: 25/50 as tested in accordance with ASTM E84.
4. Aluminum Finish: Embossed.

2.10 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Mesh: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Mesh: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.11 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.12 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. 3M Industrial Adhesives and Tapes Division
b. Aeroflex USA
c. Avery Dennison Corporation, Specialty Tapes Division

d. Ideal Tape Co., Inc., an American Biltrite Company
e. Knauf Insulation
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. 3M Industrial Adhesives and Tapes Division
b. Avery Dennison Corporation, Specialty Tapes Division
c. Ideal Tape Co., Inc., an American Biltrite Company
d. Knauf Insulation
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. 3M Industrial Adhesives and Tapes Division
b. Ideal Tape Co., Inc., an American Biltrite Company
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. 3M Industrial Adhesives and Tapes Division
b. Avery Dennison Corporation, Specialty Tapes Division
c. Ideal Tape Co., Inc., an American Biltrite Company
d. Knauf Insulation
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.13 SECUREMENTS

A. Bands:
1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

2.14 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
   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. Plumberex Specialty Products, Inc.
      b. ProFlo; a Ferguson Enterprises, Inc. brand
      c. Truebro; IPS Corporation
   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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
   3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation made from same material and density as that of adjacent pipe insulation. Each piece is 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 of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations where access is required. Installation conforms to the following:
   1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
   2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
   3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
   4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
   5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
   4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install prefabricated pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
   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 prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install prefabricated sections of cellular-glass insulation to valve body.
   2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
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 prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install prefabricated 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 glass-fiber or mineral-wool 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 prefabricated sections of same material as that of straight segments of pipe insulation when available.

2. When prefabricated 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 prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section "Exterior Painting" and Section "Interior Painting."

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 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS 1-1/4 and Smaller: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
   2. NPS 1-1/2 and Larger: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:
   1. NPS 1-1/4 and Smaller: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.
   2. NPS 1-1/2 and Larger: Insulation is one of the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.
      b. Mineral Wool, Preformed Pipe Insulation, Type II: 1-1/2 inches thick.

C. Domestic Chilled Water (Potable):
   1. All Pipe Sizes: Insulation is one of the following:
      a. Flexible Elastomeric: 1/2 inch thick.
      b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
      c. Mineral Wool, Preformed Pipe Insulation, Type II: 1/2 inch thick.

D. Stormwater and Overflow:
   1. All Pipe Sizes: Insulation is one of the following:
      a. Flexible Elastomeric: 1 inch thick.
      b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      c. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

E. Roof Drain and Overflow Drain Bodies:
   1. All Pipe Sizes: Insulation is one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      d. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. Manufactured pipe insulation system designed for ADA requirements.

G. Sanitary Waste Piping Where Heat Tracing Is Installed:
   1. All Pipe Sizes: Insulation is one of the following:
      a. Cellular Glass: 2 inches thick.
      b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

H. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
   1. All Pipe Sizes: Insulation is one of the following:
      a. Flexible Elastomeric: 1 inch thick.
      b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:
   1. All Pipe Sizes: Insulation is the following:
      a. Cellular Glass: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:
   1. All Pipe Sizes: Insulation is the following:

a. Cellular Glass: 2 inches thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:
1. All Pipe Sizes: Insulation is the following:
a. Cellular Glass: 2 inches thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. None.

D. Piping, Exposed:
1. PVC: 20 mils thick.
2. Aluminum, Smooth: 0.016 inch thick.
3. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.010 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. PVC: 30 mils thick.
2. Aluminum, Smooth: 0.016 inch thick.

D. Piping, Exposed:
1. PVC: 40 mils thick.
2. Aluminum, Smooth with Z-Shaped Locking Seam: 0.016 inch thick.
3. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish with Z-Shaped Locking Seam: 0.010 inch thick.

END OF SECTION 220719

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SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Copper tube and fittings - domestic water.
   2. Ductile-iron pipe and fittings - domestic water.
   3. Polypropylene (PP-R and PP-RCT) pipe and fittings - domestic water.
   4. Piping joining materials - domestic water.
   5. Transition fittings - domestic water.
   6. Dielectric fittings - domestic water.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Copper tube and fittings - domestic water.
   2. Ductile-iron pipe and fittings - domestic water.
   3. Polypropylene (PP-R and PP-RCT) pipe and fittings - domestic water.
   4. Piping joining materials - domestic water.
   5. Transition fittings - domestic water.
   6. Dielectric fittings - domestic water.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, showing the items described in this Section, and coordinated with all building trades.
   1. Drawings shall clearly indicate piping material proposed for use at each location. Basis of design is copper unless noted otherwise in the Drawings. Where alternate materials are proposed, increase sizes as necessary to provide equivalent hydraulic diameter, and clearly indicate on Coordination Drawings.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installers of pressure-sealed joints are to be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service in accordance with requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
   2. Do not interrupt water service without Architect's written permission.

1.6 WARRANTY

A. Polypropylene (PP-R and PP-RCT) Pipe and Fittings Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R and PP-RCT pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.
   1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of piping system due to defects in materials or manufacturing.

2. Warranty is to be in effect only upon submission by Contractor to manufacturer of valid pressure/leak documentation indicating that the system was tested and passed manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water piping, tubing, fittings, joints, and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 COPPER TUBE AND FITTINGS - DOMESTIC WATER

A. Drawn-Temper Copper Tube: ASTM B88, Type K ASTM B88, Type L.
   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. Cambridge-Lee Industries, LLC
      b. Cerro Flow Products, LLC
      c. Mueller Streamline Co.; a company of Mueller Industries

B. Annealed-Temper Copper Tube: ASTM B88, Type K ASTM B88, Type L.
   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. Cambridge-Lee Industries, LLC
      b. Cerro Flow Products, LLC
      c. Mueller Streamline Co.; a company of Mueller Industries

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.
   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. Elkhart Products Corporation; a part of Aalberts Integrated Piping Systems
      b. Mueller Streamline Co.; a company of Mueller Industries
      c. NIBCO INC.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Do not use solder joints on pipe sizes greater than NPS 4.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends. Do not use solder joints on pipe sizes greater than NPS 4.

G. Wrought Copper Unions: ASME B16.22. Do not use solder joints on pipe sizes greater than NPS 4.

H. Pressure-Seal-Joint Fittings, Copper or Bronze - Domestic Water:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems
      b. Conex Banninger - USA
      c. Copper Press Brand; Merit Brass Company
      d. Elkhart Brass Mfg. Co., Inc
      e. FNW; Ferguson Enterprises, Inc.
      f. Mueller Streamline Co.; a company of Mueller Industries
      g. NIBCO INC.

h. Viega LLC
2. Source Limitations: Obtain pressure-seal-joint fittings, copper or bronze, from single manufacturer.
3. Housing: Copper.
4. O-Rings and Pipe Stops: EPDM.
5. Tools: Manufacturer's special tools.
6. Minimum 200 psig working-pressure rating at 250 deg F.

2.3 DUCTILE-IRON PIPE AND FITTINGS - DOMESTIC WATER

A. Mechanical-Joint, Ductile-Iron Pipe:
1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:
1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:
1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on Joint, Ductile-Iron Pipe:
1. AWWA C151/A21.51.
2. Push-on joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on Joint Fittings:
1. AWWA C110/A21.10, ductile or gray iron.
2. Gaskets: AWWA C111/A21.11, rubber.

F. Compact-Pattern, Push-on Joint Fittings:
1. AWWA C153/A21.53, ductile iron.
2. Gaskets: AWWA C111/A21.11, rubber.

G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

H. Appurtenances for Grooved-End, Ductile-Iron Pipe - Domestic Water:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Apollo Valves; a part of Aalberts Integrated Piping Systems
b. ASC Engineered Solutions
c. Shurjoint; a part of Aalberts Integrated Piping Systems
d. Smith-Cooper International
e. Star Pipe Products
f. Victaulic Company
2. Source Limitations: Obtain appurtenances for grooved-end, ductile-iron pipe from single manufacturer.
3. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions that match pipe.
4. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
a. AWWA C606 for ductile-iron-pipe dimensions.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating:

1) NPS 14 to NPS 18 (DN 350 to DN 450): 250 psig.
2) NPS 20 to NPS 46 (DN 500 to DN 900): 150 psig.

2.4 POLYPROPYLENE (PP-R AND PP-RCT) PIPE AND FITTINGS - DOMESTIC WATER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. aquatherm
2. Nupi Americas

B. Source Limitations: Obtain polypropylene (PP-R and PP-RCT) pipe and fittings from single manufacturer.

C. Polypropylene (PP-R and PP-RCT) Pipe and Fittings: ASTM F2389, pipe pressure rating to comply with temperature and pressure ratings of code requirements for applicable service.
1. Polypropylene Fittings: ASTM F2389, socket fusion, butt fusion, electrofusion, or fusion outlet fittings to be used for fusion-welded joints between pipe and fittings.
2. Mechanical fittings and transition fittings to be used where transitions are made to other piping materials or to valves and appurtenances.
3. Polypropylene pipe is to be unthreaded. Threaded transition fittings per ASTM F2389 to be used where a threaded connection is required.

D. Smoke and Fire Ratings:
1. Where installed in a plenum, piping shall be plenum rated or insulated as recommended by Manufacturer to achieve plenum rating.
2. System is to have a flame-spread index of less than 25 and smoke-developed index of less than 50.
3. Pipe, wrap, or insulate as a system to comply with requirements of CAN/ULC-S102.2-03, ASTM E84, or UL 2846.
4. For insulation required for thermal and condensation reasons, see Section 220719 "Plumbing Piping Insulation."

E. Integration of PP-R and PP-RCT Piping Systems with Other Systems:
1. When integrating PP-R and PP-RCT piping systems with other systems or with components not made of PP-R or PP-RCT (for example, valves, pumps, other piping, check valves, or strainers), ensure that operating parameters for PP-R and PP-RCT will not damage other materials in the system or vice versa.
2. Verify that all parts of the system are compatible with the medium being carried before installation. PP-R and PP-RCT pipe do not require treatment to protect them from corrosion. Metals (ferrous and non-ferrous) in the system may be susceptible to corrosion. Provide water treatment to protect system metals.
3. Do not mix PP-R and PP-RCT pipe with other piping systems in conditions that will cause the other system or components to fail.
4. For Domestic Hot Water Recirculation (DHWR) Systems:
    a. When using copper piping in conjunction with PP-R and PP-RCT in a DHWR system, ensure that operating conditions will not cause degradation or erosion/corrosion of copper.
    b. Follow CDA guidelines (CDA's "Copper Tube Handbook") for sizing, temperature, and flow velocity in the copper tubing.
    c. Sustained high levels of copper in DHWR piping can damage components within the system, even PP-R and PP-RCT.
    d. Ensure that maximum hot-water temperature within any part of the system/loop does not exceed 140 deg F. Some regulations and codes further restrict temperature at any fixture to maximum of 120 deg F. Do not exceed temperature rating of pipe for the operating pressure.
    e. Maximum temperature used must not exceed rating of pipe for the operating pressure.
    f. Flow rates in a DHWR system should not exceed 1.5 ft./sec anywhere in the system, except in some special cases where velocities up to 3 ft./sec are needed to achieve proper flow temperature.

g. When adding PP-R or PP-RCT to an existing copper system in a DHWR application, the level of copper in the water must be tested. Do not install PP-R or PP-RCT where dissolved copper levels exceed 0.1 mg/L (ppm).

F. PP-R and PP-RCT Socket Fittings: ASTM F2389.

2.5 PIPING JOINING MATERIALS - DOMESTIC WATER

A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.6 TRANSITION FITTINGS - DOMESTIC WATER

A. General Requirements:
1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Couplings - Domestic Water: AWWA C219.
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. Cascade Waterworks Mfg. Co.
b. Dresser Pipeline Solutions
c. Ford Meter Box Company, Inc. (The)
d. Jay R. Smith Mfg Co; a division of Morris Group International
e. JCM Industries, Inc
f. Romac Industries, Inc.
g. Smith-Blair, a Xylem brand.
h. Viking Johnson
2. Source Limitations: Obtain sleeve-type transition couplings from single manufacturer.

D. Plastic-to-Metal Transition Unions - Domestic Water:
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. aquatherm
b. Colonial Engineering, Inc.
c. NIBCO INC.
d. Spears Manufacturing Company
2. Source Limitations: Obtain plastic-to-metal transition unions from single manufacturer.
3. Description:
a. Brass threaded end.
b. Solvent-cement-joint or threaded plastic end.
c. Rubber O-ring.
d. Union nut.

2.7 DIELECTRIC FITTINGS - DOMESTIC WATER

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions - Domestic Water:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. A.Y. McDonald Mfg. Co.
      b. Apollo Valves; a part of Aalberts Integrated Piping Systems
      c. HART Industrial Unions, LLC
      d. Jomar Valve
      e. Matco-Norca
      f. WATTS; A Watts Water Technologies Company
      g. Zurn Industries, LLC
   2. Source Limitations: Obtain dielectric unions from single manufacturer.
   3. Standard: ASSE 1079.
   4. Pressure Rating: 125 psig minimum at 180 deg F.
   5. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges - Domestic Water:
   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. Capitol Manufacturing Company
      b. GF Piping Systems: Georg Fischer LLC
      c. Matco-Norca
      d. WATTS; A Watts Water Technologies Company
      e. Zurn Industries, LLC
   2. Source Limitations: Obtain dielectric flanges from single manufacturer.
   3. Standard: ASSE 1079.
   4. Factory-fabricated, bolted, companion-flange assembly.
   5. Pressure Rating: 125 psig minimum at 180 deg F.
   6. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples - Domestic Water:
   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. Anvil; an ASC Engineered Solution
      b. Apollo Valves; a part of Aalberts Integrated Piping Systems
      c. Matco-Norca
      d. Sioux Chief Manufacturing Company, Inc.
      e. Victaulic Company
   2. Source Limitations: Obtain dielectric nipples from single manufacturer.
   3. Standard: IAPMO PS 66.
   4. Electroplated steel nipple complying with ASTM F1545.
   5. Pressure Rating and Temperature: 300 psig at 225 deg F.
   6. End Connections: Male threaded or grooved.
   7. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller is to be the following:
   1. Annealed-temper copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
   2. Polypropylene (PP-R and PP-RCT), SDR 7.4 SDR 11 pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) and larger is to be the following:
   1. Annealed-temper copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
   2. Polypropylene (PP-R and PP-RCT), SDR 7.4 SDR 11 pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

E. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller is to be the following:
   1. wrought-copper, solder-joint fittings; and brazed joints.
   2. Polypropylene (PP-R and PP-RCT), SDR 7.4 SDR 11 pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

F. Aboveground domestic water piping, NPS 2 (DN 50) and smaller is to be the following:
   1. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
   2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
   3. Drawn-temper copper tube, ASTM B88, Type L; copper push-on joint fittings; and push-on joints.
   4. Polypropylene (PP-R and PP-RCT), SDR 7.4 SDR 11 pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) is to be the following:
   1. Drawn-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
   2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
   3. Drawn-temper copper tube, ASTM B88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
   4. Polypropylene (PP-R and PP-RCT), SDR 7.4 SDR 11 pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

H. Aboveground domestic water piping, NPS 5 to NPS 8 (DN 125 to DN 200), is to be the following:
   1. Drawn-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
   2. Drawn-temper copper tube, ASTM B88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
   3. Polypropylene (PP-R and PP-RCT) SDR 7.4 SDR 11 pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab in accordance with CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints in accordance with AWWA C600 and AWWA M41.

D. Install underground copper tube and ductile-iron pipe in PE encasement in accordance with ASTM A674 or AWWA C105/A21.5.

E. Install valves in accordance with Section 220523 "General-Duty Valves for Plumbing Piping."

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level without pitch and plumb.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220500 "Common Work Results for Plumbing."

Q. All stubouts to fixtures are to be copper.

R. Do not route piping above or below any electrical equipment (panelboards, transformers, disconnect switches, etc.)

S. Unless noted otherwise, pipe sizes indicated on drawings are based on copper. Where alternate materials are used, sizes shall be increased to provide equivalent hydraulic diameter.

T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123.21 "Inline, Domestic Water Pumps."

U. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220500 "Common Work Results for Plumbing."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

G. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints in accordance with AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts in accordance with ASME B31.9.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.5 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Install hangers for copper ductile iron tube and pipe, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install vinyl-coated hangers for PP-R/PP-RCT pipe, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper tube and pipe to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of PP-R/PP-RCT pipe to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
   2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system in accordance with either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Repeat procedures if biological examination shows contamination.
      e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Tests and Inspections:
    1. Piping Inspections:
        a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
        b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
            1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after installation and before setting fixtures.
            2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
        c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
        d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
    2. Piping Tests:
        a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
        b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
        c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
        d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
        e. Hydrostatic testing and documentation of test results for polypropylene (PP-R and PP-RCT) pipe to be in accordance with manufacturer's written instructions and submitted to manufacturer upon successful completion per warranty requirements.
        f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
        g. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Outlet boxes.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water-hammer arresters.
11. Flexible connectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.
1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Apollo Valves; a part of Aalberts Integrated Piping Systems
b. Cash Acme Plumbing Products; an RWC brand
c. FEBCO; A WATTS Brand
d. WATTS; A Watts Water Technologies Company
e. Zurn Industries, LLC

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: Chrome plated.

B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Apollo Valves; a part of Aalberts Integrated Piping Systems
   b. Cash Acme Plumbing Products; an RWC brand
   c. Champion-Arrowhead
   d. Jay R. Smith Mfg Co; a division of Morris Group International
   e. MIFAB, Inc
   f. WATTS; A Watts Water Technologies Company
   g. Woodford Manufacturing Company
   h. Zurn Industries, LLC
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: Chrome or nickel plated.

2.4 BACKFLOW PREVENTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ames Fire & Waterworks; A Watts Water Technologies Company
2. Apollo Valves; a part of Aalberts Integrated Piping Systems
3. Caleffi North America
4. FEBCO; A WATTS Brand
5. WATTS; A Watts Water Technologies Company
6. Zurn Industries, LLC

B. Intermediate Atmospheric-Vent Backflow Preventers:
1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/2.
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Rough bronze.

C. Reduced-Pressure-Principle Backflow Preventers:
1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.
4. Size: As indicated on Drawings.
5. Body: Bronze or stainless steel for NPS 2 and smaller; ductile or cast iron with interior lining that complies with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:
   a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
   b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
   c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

D. Double-Check, Backflow-Prevention Assemblies:
1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.

3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Size: As indicated on Drawings.
5. Body: Bronze or stainless steel for NPS 2 and smaller; ductile or cast iron with interior lining that complies with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:
    a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

E. Beverage-Dispensing-Equipment Backflow Preventers:
1. Standard: ASSE 1022.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/4 or NPS 3/8.
4. Body: Stainless steel or non-metallic.
5. End Connections: Threaded or flare.

F. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:
1. Standard: ASSE 1032.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/4 or NPS 3/8.
4. Body: Stainless steel.
5. End Connections: Threaded or flare.

G. Hose-Connection Backflow Preventers:
1. Standard: ASSE 1052.
2. Operation: Up to 10-ft. head of water back pressure.
3. Inlet Size: NPS 3/4.
4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
5. Capacity: At least 3-gpm flow.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Apollo Valves; a part of Aalberts Integrated Piping Systems
    b. Caleffi North America
    c. Cash Acme Plumbing Products; an RWC brand
    d. WATTS; A Watts Water Technologies Company
    e. Zurn Industries, LLC
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Size: As indicated on Drawings.
5. Design Inlet Pressure:As indicated on Drawings.
6. Design Outlet Pressure Setting: Insert psigAs indicated on Drawings.
7. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
8. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.

2.6 Condensation Funnel for Clothes Washers Outlet Boxes

A. Basis-of-Design Product: Subject to compliance with requirements, provide <**Sioux Chief**> or comparable product by one of the following:
1. Accor Technology, Inc.

2.7 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:
   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. Bell & Gossett; a Xylem brand
      b. IMI
      c. Nexus Valve, Inc.; Aalberts Hydronic Flow Control
      d. NIBCO INC.
      e. WATTS; A Watts Water Technologies Company
   2. Type: Ball valve with two readout ports and memory-setting indicator.
   3. Body: Brass or bronze.
   4. Size: Same as connected piping, but not larger than NPS 2.

B. Memory-Stop Balancing Valves:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems
      b. Caleffi North America
      c. Crane Fluid Systems; Crane Co.
      d. Hammond Valve
      e. Jenkins Valves; a Crane Co. brand
      f. Milwaukee Valve Company
      g. NIBCO INC.
      h. Red-White Valve Corp.
      i. Stockham; a Crane Co. brand
   2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
   3. Pressure Rating: 400-psig minimum CWP.
   4. Size: NPS 2 or smaller.
   5. Body: Copper alloy.
   6. Port: Standard or full port.
   7. Ball: Chrome-plated brass or stainless steel.
   8. Seats and Seals: Replaceable.
   9. End Connections: Solder joint or threaded.
   10. Handle: Vinyl-covered steel with memory-setting device.

2.8 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:
   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. Acorn Controls; a Division of Morris Group International
      b. Acorn Engineering Company; a Division of Morris Group International
      c. Caleffi North America
      d. Lawler Manufacturing Company, Inc
      e. Leonard
      f. POWERS; A Watts Water Technologies Company
      g. Zurn Industries, LLC
   2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
   3. Pressure Rating: 125 psig minimum unless otherwise indicated.
   4. Material: Bronze body with corrosion-resistant interior components.
   5. Temperature Control: Adjustable.
   6. Connections: Threaded inlets and outlet.
   7. Finish: Chrome plated.
   8. Tempered-Water Setting: 110 deg F.

2.9 HOSE BIBBS

A. Hose Bibbs:
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. Jay R. Smith Mfg Co; a division of Morris Group International
   b. Josam Company
   c. MIFAB, Inc
   d. Prier Products, Inc.
   e. WATTS; A Watts Water Technologies Company
   f. Woodford Manufacturing Company
   g. Zurn Industries, LLC
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Rough bronze.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle.
13. Operation for Service Areas: Wheel handle.
14. Operation for Finished Rooms: Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
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. Jay R. Smith Mfg Co; a division of Morris Group International
   b. Josam Company
   c. MIFAB, Inc
   d. Murdock Manufacturing; A Division of Morris Group International
   e. Prier Products, Inc.
   f. WATTS; A Watts Water Technologies Company
   g. Woodford Manufacturing Company
   h. Zurn Industries, LLC
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 mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet, Exposed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Rough bronze.
12. Operating Keys(s): One with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants:

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. Jay R. Smith Mfg Co; a division of Morris Group International
    b. Josam Company
    c. MIFAB, Inc
    d. Murdock Manufacturing; A Division of Morris Group International
    e. Prier Products, Inc.
    f. WATTS; A Watts Water Technologies Company
    g. Woodford Manufacturing Company
    h. Zurn Industries, LLC
2. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Vacuum Breaker:
    a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Key(s): One with each wall hydrant.

2.11 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
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. AMTROL, Inc.
    b. Jay R. Smith Mfg Co; a division of Morris Group International
    c. Josam Company
    d. MIFAB, Inc
    e. Precision Plumbing Products
    f. ProFlo; a Ferguson Enterprises, Inc. brand
    g. Sioux Chief Manufacturing Company, Inc.
    h. WATTS; A Watts Water Technologies Company
    i. Zurn Industries, LLC
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.12 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:
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. Jay R. Smith Mfg Co; a division of Morris Group International
    b. Josam Company
    c. MIFAB, Inc
    d. Precision Plumbing Products
    e. ProFlo; a Ferguson Enterprises, Inc. brand
    f. Sioux Chief Manufacturing Company, Inc.
    g. WATTS; A Watts Water Technologies Company
    h. Zurn Industries, LLC
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.

4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Jay R. Smith Mfg Co; a division of Morris Group International
   b. MIFAB, Inc
   c. Precision Plumbing Products
   d. Zurn Industries, LLC
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

2.13 FLEXIBLE CONNECTORS

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. Flex-Hose Co., Inc
2. Mason Industries, Inc.
3. Metraflex Company (The)

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

C. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.

C. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Y-Pattern Strainers: For water, install on supply side of each pump.

F. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

D. Adjust each reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

END OF SECTION 221119

SECTION 221123.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.2 ACTION SUBMITTALS

A. Product Data Submittals: For each product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, 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. Structural members to which pumps will be attached.
   2. Size and location of initial access modules for acoustical tile.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: UL 778 for motor-operated water pumps.

C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

2.2 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Bell & Gossett; a Xylem brand
   2. Taco Comfort Solutions

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

C. Capacities and Characteristics: As indicated on Drawings.

D. Pump Construction:
   1. Casing:

a. Radially split bronze with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
c. Gauge port tappings at suction and discharge nozzles.

2. Impeller: Bronze or brass, statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
6. Bearings: permanently lubricated ball type.
7. Minimum Working Pressure: 175 psig.
8. Continuous Operating Temperature: 225 deg F.

E. Motor: Single speed, with grease-lubricated ball bearings; rigidly mounted to pump casing.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220500 "Common Work Results for Plumbing."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

3.2 INSTALLATION OF PUMPS

A. Comply with HI 1.4.

B. Mount pumps in orientation complying with manufacturer's written instructions.

C. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.
1. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

D. Install thermostats in hot-water return piping.

3.3 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.

C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
c. Vertically mounted, in-line, close-coupled centrifugal pumps.
d. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties." Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
   1. Install pressure gauge at suction of each pump and pressure gauge at discharge of each pump. Install at integral pressure-gauge tappings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 220500 "Common Work Results for Plumbing."

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between temperature controllers and devices.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 ADJUSTING

A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123.21

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SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hubless, cast-iron soil pipe and fittings.
   2. PVC pipe and fittings.
   3. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Installation photographs.
   1. After installation of underground piping and support, but prior to backfilling, submit photographs showing entirety of underground piping system.

C. Field quality-control reports.

1.4 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10 ft. head of water.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

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. AB & I Foundry; a part of the McWane family of companies
   2. Charlotte Pipe and Foundry Company
   3. Tyler Pipe; a part of the McWane family of companies

B. Pipe and Fittings:
   1. Marked with CISPI collective trademark.
   2. ASTM A888 or CISPI 301.

C. CISPI, Hubless-Piping Couplings:
   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. ANACO-Husky; a part of the McWane family of companies
      b. Charlotte Pipe and Foundry Company

c. Dallas Specialty & Mfg. Co.
d. Fernco Inc
e. Ideal Tridon Group
f. Matco-Norca
g. MIFAB, Inc
h. Mission Rubber Company, LLC
i. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C1277 and CISPI 310.
3. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:
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. AB & I Foundry; a part of the McWane family of companies
b. ANACO-Husky; a part of the McWane family of companies
c. Charlotte Pipe and Foundry Company
d. Clamp-All Corp
e. Dallas Specialty & Mfg. Co.
f. Ideal Tridon Group
g. MIFAB, Inc
h. Mission Rubber Company, LLC
i. Tyler Pipe; a subsidiary of McWane Inc.
2. Standards: ASTM C1277 and ASTM C1540. <**Insert standard**>.
3. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

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. Apollo Valves; a part of Aalberts Integrated Piping Systems
2. Charlotte Pipe and Foundry Company
3. GF Piping Systems
4. JM Eagle
5. National Pipe and Plastic, Inc. (Oldcastle)
6. North America Pipe Corporation
7. Rocky Mountain Colby Pipe Company
8. Silver-line Plastics

B. Comply with NSF 14 for plastic piping components. Include "NSF-dwv" marking for plastic drain, waste, and vent piping and "NSF-sewer" marking for plastic sewer piping.

C. Solid-Wall PVC Pipe: ASTM D2665 drain, waste, and vent.

D. Cellular-Core PVC Pipe: ASTM F891, Schedule 40.

E. PVC Socket Fittings: ASTM D2665, made in accordance with ASTM D3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

F. Adhesive Primer: ASTM F656.

G. Solvent Cement: ASTM D2564.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc
        3) Mission Rubber Company, LLC
        4) Plastic Oddities
    b. Standard: ASTM C1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. End Connections: Same size as and compatible with pipes to be joined.
    e. Sleeve Materials:
        1) For Cast-Iron Soil Pipes: ASTM C564, rubber.
        2) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926 PVC.
        3) For Dissimilar Pipes: ASTM D5926 PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
    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) Cascade Waterworks Mfg. Co.
        2) Mission Rubber Company, LLC
    b. Standard: ASTM C1460.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. End Connections: Same size as and compatible with pipes to be joined.
5. Pressure Transition Couplings:
    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) Apollo Valves; a part of Aalberts Integrated Piping Systems
        2) Cascade Waterworks Mfg. Co.
        3) EBAA Iron Sales, Inc.
        4) Ford Meter Box Company, Inc. (The)
        5) JCM Industries, Inc
        6) Romac Industries, Inc.
    b. Standard: AWWA C219.
    c. Description: Metal sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
    d. Center-Sleeve Material: Manufacturer's standard.
    e. Gasket Material: Natural or synthetic rubber.
    f. Metal Component Finish: Corrosion-resistant coating or material.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
    1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
    2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation where applicable.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
   1. 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.
   2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
      a. Straight tees, elbows, and crosses may be used on vent lines.
   3. Do not change direction of flow more than 90 degrees.
   4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
      a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.
   1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
   2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
   3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
   1. Sanitary Drain: Two 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. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install aboveground PVC piping in accordance with ASTM D2665.

O. Install underground PVC piping in accordance with ASTM D2321.

P. Install engineered soil and waste and vent piping systems as follows:
   1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

Q. Plumbing Specialties:
   1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
      a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
   2. Install drains in sanitary waste gravity-flow piping.
      a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

T. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

V. Trenching:
1. Notify Architect of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
2. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
3. Do not interfere with 45 degree bearing splay of foundations.
4. Cut trenches wide enough to allow inspection of installed utilities.
5. Hand trim excavations and remove loose material.
6. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
7. Remove excavated material that is unsuitable for re-use from site.
8. Remove excess excavated material from site.

W. Backfilling:
1. Utilize sand for bedding of pipe, and for backfill to a minimum of 6” over the top of pipes.
2. Hand tamp sand below all piping to ensure continuous support of entire piping system prior to backfilling.
3. Fill to subgrade elevations unless otherwise indicated.
4. Employ placement method that does not disturb or damage other work.
5. Systematically fill to allow maximum time for natural settlement.
    a. Do not fill over porous, wet, frozen or spongy subgrade;
    b. Maintain optimum moisture content of fill materials to attain required compaction density.
    c. Place materials in equal continuous layers not exceeding 6” compacted depth for each layer.

3.2 JOINT CONSTRUCTION

A. Hubless, Cast-Iron Soil Piping Coupled Joints:
1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendixes.

3.3 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

B. Dielectric Fittings:
1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.4 INSTALLATION OF VALVES

A. General valve installation requirements for general-duty valve installation are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:
   1. Install shutoff valve on each sewage pump discharge.
   2. Install full-port ball valve for piping NPS 2 and smaller.
   3. 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 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. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment".
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
   3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
   4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
   5. Vertical Piping: MSS Type 8 or Type 42 clamps.
   6. Install individual, straight, horizontal piping runs:
      a. 100 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Ft. (30 m) if Indicated: MSS Type 49, spring cushion rolls.
   7. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
   8. Base of Vertical Piping: MSS Type 52 spring hangers.

B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

E. Support vertical runs of cast-iron soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:
   1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
   5. Equipment: Connect waste piping as indicated.
      a. Provide shutoff valve if indicated and union for each connection.
      b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections in accordance with 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.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
      a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
      a. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
      a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
      b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
      c. Inspect joints for leaks.
   4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg.
b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
c. Air pressure must remain constant without introducing additional air throughout period of inspection.
d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. The use of PVC, where allowed in paragraphs below, shall be limited to spaces not utilized as return air plenums.

C. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller are to be the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Aboveground, soil and waste piping NPS 5 (DN 125) and larger are to be the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 4 (DN 100) is to be the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

F. Aboveground, vent piping NPS 5 (DN 125) and larger is to be the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

G. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller are to be the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

H. Underground, soil and waste piping NPS 5 (DN 125) and larger are to be the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; coupled joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Miscellaneous sanitary drainage piping specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:
   1. 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. Jay R. Smith Mfg Co; a division of Morris Group International
      b. Josam Company
      c. MIFAB, Inc
      d. Tyler Pipe; a subsidiary of McWane Inc.
      e. WATTS; A Watts Water Technologies Company
      f. Zurn Industries, LLC
   2. Standard: ASME A112.36.2M.
   3. Size: Same as connected drainage piping
   4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   5. Closure: Countersunk or raised-head, brass plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:
   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. Jay R. Smith Mfg Co; a division of Morris Group International
      b. Josam Company
      c. MIFAB, Inc
      d. Sioux Chief Manufacturing Company, Inc.
      e. WATTS; A Watts Water Technologies Company
      f. Zurn Industries, LLC
   2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
   3. Size: Same as connected branch.
   4. Type: Adjustable housing.
   5. Body or Ferrule: Cast iron.
   6. Outlet Connection: Threaded.
   7. Closure: Brass plug with tapered threads.
   8. Adjustable Housing Material: Plastic with setscrews or other device.
   9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   10. Frame and Cover Shape: Round.
   11. Top-Loading Classification: Heavy Duty.
   12. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:
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. Jay R. Smith Mfg Co; a division of Morris Group International
b. Josam Company
c. MIFAB, Inc
d. WATTS; A Watts Water Technologies Company
e. Zurn Industries, LLC
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:
a. Brass.
b. Countersunk or raised head.
c. Drilled and threaded for cover attachment screw.
d. Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.

D. Plastic Floor Cleanouts:
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. Endura; a brand of IPEX
b. IPS Corporation
c. NDS Inc
d. Plastic Oddities
e. Sioux Chief Manufacturing Company, Inc.
f. Zurn Industries, LLC
2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.
5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains Insert drawing designation, if any:
1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of a minimum of 2 pipe sizes or size indicated.

B. Deep-Seal Traps Insert drawing designation, if any:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
a. NPS 2: 4-inch- minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings Insert drawing designation, if any:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Floor-Drain, Inline Trap Seal (Insert drawing designation, if any):
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. Green Drain, Inc.

b. Jay R. Smith Mfg Co; a division of Morris Group International
c. Josam Company
d. MIFAB, Inc
e. RectorSeal Plumbing; A CSW Industrials Company
f. Insert manufacturer's nameProset

2. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
3. Material: Polymer.
4. Standard: Tested and certified in accordance with ASSE 1072.
5. Listing: IAPMO listed.
6. Size: Same as floor drain outlet or strainer throat.

E. Air-Gap Fittings Insert drawing designation, if any:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

F. Expansion Joints Insert drawing designation, if any:
1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install 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 2-way cleanouts at main building drain, maximum 5’ from building wall.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Assemble open drain fittings and install with top of hub 2 inches above floor.

E. Install deep-seal traps on floor drains and other waste outlets, if indicated.

F. 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.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install wood-blocking reinforcement for wall-mounting-type specialties.

I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
   1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Floor drains.
   2. Trench drains.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sanitary drains are to bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Floor Drain - Cast Iron:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Jay R. Smith Mfg Co; a division of Morris Group International
      b. Josam Company
      c. MIFAB, Inc
      d. Sioux Chief Manufacturing Company, Inc.
      e. Wade; a subsidiary of McWane Inc.
      f. WATTS; A Watts Water Technologies Company
      g. Zurn Industries, LLC
   2. Source Limitations: Obtain cast-iron floor drains from single manufacturer.
   3. Standard: ASME A112.6.3 with backwater valve.
   4. Pattern: Floor drain.
   5. Body Material: Gray iron.
   6. Seepage Flange: as required.
   7. Anchor Flange: as required.
   8. Clamping Device: as required.
   9. Outlet: Bottom.
   10. Coating on Interior and Exposed Exterior Surfaces: Not required.
   11. Sediment Bucket: Not required.
   12. Top or Strainer Material: Stainless steel.
   13. Top of Body and Strainer Finish: Stainless steel.
   14. Top Shape: Round.
   15. Funnel: Provide where indicated on drawings.
   16. Inlet Fitting: Not required.
   17. Trap Material: Cast iron.
   18. Trap Pattern: Deep-seal P-trap.

2.3 TRENCH DRAINS

A. Trench Drain, Modular Channel System - Polymer Concrete, Narrow, Sloped Invert:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABT, Inc.
      b. ACO, Inc.

c. [**Jay R. Smith Mfg Co; a division of Morris Group International**]

2. Source Limitations: Obtain narrow, sloped-invert, polymer-concrete channel drainage systems from single manufacturer.
3. Standard: ASME A112.6.8.
4. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
5. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps.
   a. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated.
   b. Include extension sections necessary for required depth.
   c. Dimensions: Width as scheduled. Include number of units required to form total lengths indicated.
6. Grates: Manufacturer's designation "Heavy Duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.
   a. Material: Ductile iron.
   b. Locking Mechanism: Not required.
7. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
8. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

B. Trench Drain, Modular Channel System - FRP:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ACO, Inc.
   b. Jay R. Smith Mfg Co; a division of Morris Group International
   c. MIFAB, Inc
   d. Zurn Industries, LLC
2. Source Limitations: Obtain FRP channel drainage systems from single manufacturer.
3. Standard: ASME A112.6.8.
4. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
5. Channel Sections: Interlocking-joint, sloped-invert, FRP modular units, with end caps. Include flat, rounded, or inclined inside bottom, with outlets in number, sizes, and locations indicated.
   a. Dimensions: Width as indicated on drawings. Include number of units required to form total lengths indicated.
   b. Frame: Manufacturer's standard metal for grates.
6. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.
   a. Material: Gray iron.
   b. Locking Mechanism: Not required.
7. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
8. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF SANITARY DRAINS

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
   a. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

C. Comply with ASME A112.3.1 for installation of stainless steel channel drainage systems.
   1. Install on support devices, so that top will be flush with adjacent surface.

D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.

E. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

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SECTION 221323 - SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interceptors, grease.

1.2 DEFINITIONS

A. FOGs: Fats, oils, greases.

B. FRP: Fiberglass-reinforced plastic.

C. PP: Polypropylene.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of sanitary waste interceptor.
   1. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
   2. Include diagrams of power wiring.

B. Shop Drawings: For each type and size of precast-concrete sanitary waste interceptor.
   1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Piping connections. Include size, location, and elevation of each.
   2. Interface with underground structures and utility services.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste interceptors to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 INTERCEPTORS, GREASE

A. Interceptors, Grease - Plastic:
   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. Ashland PolyTrap
      b. Bio-Microbics, Inc.
      c. Canplas Industries Ltd.
      d. MIFAB, Inc
      e. Rockford Separators
      f. Schier Products Company
      g. Town & Country Plastics, Inc
      h. Zurn Industries, LLC
   2. Standard:
      a. PDI G101.
      b. ASME A112.14.3.
   3. PDI Seal: Required.
   4. Description: Factory-fabricated grease interceptor for intercepting and retaining FOG from food-preparation wastewater.

5. Body Material: Plastic.
6. Inlet, Outlet, and Vent Piping Connections: Hub, or no-hub (hubless) unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in other sections.

3.2 INSTALLATION OF SANITARY WASTE INTERCEPTORS

A. Set interceptors level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements.
1. Set tops 3 inches above finish surface elsewhere unless otherwise indicated.

D. Set tops of grating frames and grates flush with finished surface.

E. Install grease interceptors, including trapping, venting, and flow-control fitting, in accordance with authorities having jurisdiction and with clear space for servicing.
1. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.4 PROTECTION

A. Protect sanitary waste interceptors from damage during construction period.

B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION 221323

SECTION 221429 - SUMP PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sump pumps - submersible.
   2. Sump-pump basins and basin covers.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Sump pumps - submersible.
   2. Sump-pump basins and basin covers.

B. Product Data Submittals: For each product.
   1. Construction details, material descriptions, dimensions of individual components and profiles.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Shop Drawings:
   1. Include plans, elevations, sections, and [**mounting**][**attachment**] details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls.
   1. Indicate actual installed items by marking submittals with an arrow or box.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with manufacturer's written instructions for handling.

1.5 WARRANTY

A. Manufacturer Warranty: Manufacturer agrees to repair or replace sump pumps that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Period: 1 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of sump pump from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

2.3 SUMP PUMPS - SUBMERSIBLE

A. Sump Pumps - Submersible, Fixed Position, Single Seal: .
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. GRUNDFOS CBS Inc.
      b. Liberty Pumps
      c. Pentair Aurora; Pentair Pump Group
      d. Weil Pump; a Wilo Company
      e. Xylem
      f. Zoeller Company
   2. Description: Factory-assembled and -tested sump-pump unit.
   3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 14.1-14.2 and HI 14.3.
   4. Pump Casing: Cast iron, with strainer inlet; legs that elevate pump to permit flow into impeller; and vertical discharge for piping connection.
   5. Impeller: Statically and dynamically balanced, [**manufacturer's standard**]<**Insert material**> designed for clear wastewater handling, and keyed and secured to shaft.
   6. Pump and Motor Shaft: Stainless steel or steel, with factory-sealed, grease-lubricated ball bearings.
   7. Seal: Mechanical.
   8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
   9. Capacities and Characteristics: On Drawings.
   10. Controls, Float- and Pressure-Switch Type:
      a. Enclosure: NEMA 250, Type 1; wall mounted.
      b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
      c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
      d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120 V ac, with transformer and contacts for remote alarm bell.
   11. Control-Interface Features:
      a. Remote Alarm Contacts: For remote alarm interface.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220500 "Common Work Results for Plumbing."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Motors for submersible pumps are to be hermetically sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump-pump installation.

3.2 INSTALLATION

A. Pump Installation Standards: Comply with HI 14.4 for installation of sump pumps.

B. Wiring Method: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 PIPING CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance.

3.4 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

END OF SECTION 221429

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SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gas-fired, tankless, domestic-water heaters.
   2. Gas-fired, storage, domestic-water heaters.
   3. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of domestic-water heater.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including storage tank and supports.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Periods: From date of Substantial Completion.
      a. Gas-Fired, Storage, Domestic-Water Heaters:
         1) Storage Tank: Five years.
         2) Controls and Other Components: Two year(s).
      b. Gas-Fired, Tankless, Domestic-Water Heaters:
         1) Heat Exchanger: Five years.
         2) Controls and Other Components: Three years.
      c. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.

C. ASME Compliance:
   1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A. O. Smith Corporation
   2. Navien Inc.
   3. Rheem Manufacturing Company
   4. Rinnai Corporation

B. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

C. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.

D. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
   1. Tappings: ASME B1.20.1 pipe thread.
   2. Pressure Rating: 150 psig.
   3. Heat Exchanger: Copper tubing or Stainless steel.
   4. Insulation: Comply with ASHRAE/IES 90.1.
   5. Jacket: Metal, with enameled finish, or plastic.
   6. Burner: For use with tankless, domestic-water heaters and natural-gas fuel.
   7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
   8. Temperature Control: Adjustable thermostat.

E. Support: Bracket for wall mounting.

F. Capacity and Characteristics: On Drawings.

2.3 GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A. O. Smith Corporation
      b. Bradford White Corporation
      c. Lochinvar, LLC
      d. State Water Heaters
   2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
   3. Standard: ANSI Z21.10.1/CSA 4.1.
   4. Storage-Tank Construction: Steel.
      a. Tappings: ASME B1.20.1 pipe thread.
      b. Pressure Rating: 150 psig.

c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

5. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal with hose-end connection.
   d. Insulation: Comply with ASHRAE/IES 90.1.
   e. Jacket: Steel with enameled finish.
   f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
   g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.
   h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
   i. Temperature Control: Adjustable thermostat.
   j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
6. Direct-Vent System: Through-wall or roof, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.

B. Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A. O. Smith Corporation
   b. Bradford White Corporation
   c. Lochinvar, LLC
   d. State Water Heaters
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: ANSI Z21.10.1/CSA 4.1.
4. Storage-Tank Construction: Steel.
   a. Tappings: ASME B1.20.1 pipe thread.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
5. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal with hose-end connection.
   d. Insulation: Comply with ASHRAE/IES 90.1.
   e. Jacket: Steel with enameled finish.
   f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
   g. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
   h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
   i. Temperature Control: Adjustable thermostat.
   j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
6. Power-Vent System: Exhaust fan, interlocked with burner.

C. Capacity and Characteristics: On Drawings.

2.4 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

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. O. Smith Corporation
    b. AMTROL, Inc.
    c. State Water Heaters
    d. Taco Comfort Solutions
    e. Watts
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
4. Construction:
    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Air-Charging Valve: Factory installed.
5. Capacity and Characteristics: On Drawings.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

D. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include pressure rating as required to match gas supply.

G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

H. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

J. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 18 inches above the floor.

2.5 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC-WATER HEATER

A. Domestic-Water Heater Mounting: Install domestic-water heaters as indicated on drawings.
   1. Maintain manufacturer's recommended clearances.
   2. Arrange units so controls and devices that require servicing are accessible.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.
   5. Anchor domestic-water heaters to substrate.

B. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
   1. Maintain manufacturer's recommended clearances.
   2. Arrange units so controls and devices that require servicing are accessible.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.
   5. Anchor domestic-water heaters to substrate.

C. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
   1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Install gas-fired, domestic-water heaters in accordance with NFPA 54.
   1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
   2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
   3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
   4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."

H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill domestic-water heaters with water.

J. Charge domestic-water expansion tanks with air to required system pressure.

K. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 223400

SECTION 224200 - COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Commercial lavatories.
2. Commercial sinks.
3. Commercial urinals.
4. Commercial water closets.
5. Commercial wash fountains.
6. Flushometer valves.
7. Toilet seats.
8. Fixture carriers.

1.2 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. High-Efficiency Flush Volume: 1.28 gal. or less per flush.

C. PMMA: Polymethyl methacrylate; also known as "acrylic."

D. Standard-Efficiency Flush Volume: 1.6 gal. per flush.

E. WaterSense Fixture: Water closet and/or flushometer valve/tank certified by the EPA to meet the WaterSense performance criteria.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Include construction details, material descriptions and thicknesses, dimensions of individual components and profiles, and finishes for plumbing fixtures.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
1. Plans, elevations, sections, and mounting details.
2. Details of equipment assemblies, including accessories. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, location and size of each field connection, location and size of each cutout, and anchorage provisions and attachment methods. Indicate coordination requirements for adjacent and interfacing Work.
3. Diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories and/or counter-mounted sinks.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:
1. For lavatories and faucets.
2. For shower valves to include in maintenance manuals.
3. For sinks and faucets to include in operation and maintenance manuals.
4. For flushometer valves and electronic sensors to include in operation and maintenance manuals.
5. For wash fountains and components to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials to Owner 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. Shower Valve Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
   4. Shower Valve Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
   5. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lavatory faucets, sink faucets, shower valves, and wash fountain spray heads and faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 COMMERCIAL LAVATORIES

A. Lavatory Systems:
   1. Lavatory Systems - Single or Multiple Stations:
      a. Manufacturers: Subject to compliance with requirements, provide products by the following:
         1) Acorn Engineering Company; a Division of Morris Group International
      b. Source Limitations: Obtain lavatory systems from single source from single manufacturer.
      c. Standards:
         1) ASME A112.18.1/CSA B125.1.
         2) CSA B45.5/IAPMO Z124.
         3) NSF 61.
         4) NSF 372.
         5) Uniform Plumbing Code, International Plumbing Code, and GREENGUARD Certified.
      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. Characteristics: As scheduled on drawings.
      f. Liquid-Soap Dispensers:manual operation, for each bowl or user station.
      g. Mounting: Manufacturer's wall-mounting bracket.
      h. Supply Fittings:
         1) Piping: NPS 1/2 copper tubing, each bowl.
         2) Valves: Shutoff valve on each supply.
         3) Supply Piping: From wall.
      i. Waste Fittings:
         1) Standard: ASME A112.18.2/CSA B125.2.
         2) Trap and Drain Piping: NPS 1-1/2, each bowl.

B. Lavatory Faucets, Manually Operated:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard
      b. Chicago Faucets; Geberit Group

c. Delta Faucet Company
2. Standard: ASME A112.18.1/CSA B125.1.
3. General: See Plumbing Fixture Schedule for requirements. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
5. Finish: Polished chrome plate.

C. Lavatory Supply Fittings:
1. NSF Standards: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
2. Standard: ASME A112.18.1/CSA B125.1.
3. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
4. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
5. Operation: Loose key or lever handle.
a. Risers Size: NPS 3/8.
b. Risers Material: ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel, flexible hose.

D. Lavatory Waste Fittings:
1. Standard: ASME A112.18.2/CSA B125.2.
2. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
3. Trap:
a. Size: NPS 1-1/2 by NPS 1-1/4.
b. Material:
1) Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated, brass or steel wall flange.

2.3 COMMERCIAL SINKS

A. Service Sinks, Floor Mounted:
1. Service Sinks, Floor Mounted - Terrazzo:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Acorn Engineering Company; a Division of Morris Group International
2) Fiat Products
3) Stern-Williams Products, LLC.
b. Source Limitations: Obtain sinks from single source from single manufacturer.
c. Fixture:
1) Material: Marble chips cast in portland cement to produce a compressive strength of not less than 3000 psi, seven days after casting.
2) Shape: Square.
3) Nominal Size: Indicated on drawings.
4) Rim Guard: On all top surfaces.
5) Drain: Grid with NPS 3 outlet.
d. Mounting: On floor and flush to wall.
e. Faucet:Provide faucet as scheduled..
2. Service Sinks, Floor Mounted - Molded Stone:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Fiat Products
2) Florestone Products Co., Inc.
b. Source Limitations: Obtain sinks from single source from single manufacturer.
c. Fixture:

1) Standard: ASME A112.18.2/CSA B125.2.
2) Shape: Square.
3) Nominal Size:As indicated on drawings.
4) Rim Guard: On all top surfaces.
5) Drain: Grid with NPS 3 outlet.

d. Mounting: On floor and flush to wall.

e. Faucet:Provide faucet as scheduled.

B. Kitchen/Utility Sinks:

1. Kitchen/Utility Sinks, Counter Mounted - Stainless Steel:

a. Source Limitations: Obtain sinks from single source from single manufacturer.

b. Fixture:

1) Standard: ASME A112.19.3/CSA B45.4.
2) Type: Stainless steel, self-rimming, sound-deadened unit less ledge back.
3) Number of Compartments: As indicated on drawings.
4) Overall Dimensions: As indicated on drawings.
5) Material: 18 gauge, Type 304 stainless steel.

c. Faucet(s): Provide faucet as scheduled..

d. Supply Fittings:

1) Standard: ASME A112.18.1/CSA B125.1.
2) Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
a) Operation: Loose key or lever handle.
b) Risers: NPS 1/2, ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

e. Waste Fittings:

1) Standard: ASME A112.18.2/CSA B125.2.
2) Trap(s) Size: NPS 1-1/2.
3) Trap(s) Material:
a) Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

f. Mounting: On counter with sealant or undermount with manufacturer’s recommended hardware and sealant.

C. Sink Faucets, Manually Operated:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
1) American Standard
2) Chicago Faucets; Geberit Group
3) T&S Brass and Bronze Works, Inc.
4) Delta

2. Source Limitations: Obtain sink faucets from single source from single manufacturer.

3. Standards:
1) ASME A112.18.1/CSA B125.1.
2) NSF 61.
3) NSF 372.

4. Description: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor. Refer to fixture schedule on drawings for additional requirements.

a. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.

b. Finish: Chrome plated .

5. Sink Faucets, Manually Operated - Service Sink:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Chicago Faucets; Geberit Group
2) T&S Brass and Bronze Works, Inc.

b. Source Limitations: Obtain sink faucets from single source from single manufacturer.

c. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch hose thread end, integral vacuum breaker, inlets 8 inches o.c., and two-handle mixing.

d. Faucet:

1) Standards:

a) ASME A112.18.1/CSA B125.1.
b) NSF 61 and NSF 372.
c) ICC A117.1.
d) ASSE 1001 (VB).

2) Finish: Rough chrome plated.
3) Handles: Lever.
4) Cartridges: One-fourth turn compression.
5) Brace: Adjustable top brace.

e. Vacuum Breaker: Required for hose outlet.

f. Spout Outlet: Hose thread in accordance with ASME B1.20.7.

D. Sink Supply Fittings:

1. NSF Standards: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
2. Standard: ASME A112.18.1/CSA B125.1.
3. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.
4. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
5. Operation: Loose key or metal lever.
   a. Risers Sizes: NPS 3/8.
   b. Risers Material: ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

E. Sink Waste Fittings:

1. Standard: ASME A112.18.2/CSA B125.2.
2. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
3. Trap:
   a. Size: NPS 1-1/2.
   b. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

F. Grout:

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink; recommended for interior and exterior applications.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

2.4 COMMERCIAL URINALS

A. Urinals, Wall Hung:

1. Urinals, Wall Hung:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) American Standard
      2) Kohler Co
      3) TOTO USA, INC
   b. Fixture:
      1) Standards:

a) ASME A112.19.2/CSA B45.1.
b) ASME A112.19.5/CSA B45.15.
2) Material: Vitreous china.
3) Type: Washout or washdown with extended shields.
4) Strainer or Trapway: Manufacturer's standard strainer with integral trap.
5) Water Consumption: 0.125 gpf.
6) Spud Size and Location: NPS 3/4, top.
7) Outlet Size and Location: NPS 2, back.
8) Color: White.

c. Flushometer Valve: As scheduled.

d. Waste Fitting:
1) Standard: ASME A112.18.2/CSA B125.2 for coupling.
2) Size: NPS 2.

e. Support: Urinal carrier, floor affixed with steel uprights with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.

f. Urinal Mounting Height: Refer to Architectural elevations. .

2.5 COMMERCIAL WATER CLOSETS

A. Water Closets, Floor Mounted:

1. Water Closets, Floor Mounted:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) American Standard
2) Kohler Co
3) TOTO USA, INC

b. Source Limitations: Obtain water closets from single source from single manufacturer.

c. Standard: ASME A112.19.2/CSA B45.1.

d. Bowl:
1) Material: Vitreous china.
2) Type: Siphon jet.
3) Style: Flushometer valve.
4) Height: As indicated on drawings..
5) Rim Contour: Elongated.
6) Water Consumption: 1.28 gal. per flush.
7) Spud Size and Location: NPS 1-1/2; top.
8) Color: White.

e. Flushometer Valve: As scheduled.

f. Toilet Seat: As scheduled.

2. Water Closets, Floor Mounted - Bottom Outlet, Close-Coupled Flushometer Tank:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) American Standard
2) Kohler Co
3) Toto

b. Source Limitations: Obtain water closets from single source from single manufacturer.

c. Standard: ASME A112.19.2/CSA B45.1.

d. Bowl:
1) Material: Vitreous china.
2) Type: Siphon jet.
3) Style: Flushometer tank, gravity.
4) Height: As indicated on drawings.
5) Rim Contour: Elongated.
6) Water Consumption: 1.28 gal. per flush.
7) Color: White.

e. Toilet Seat: As scheduled.

3. Water Closets, Floor Mounted - Back Outlet, Top Spud:

a. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
   1) [**American Standard**]
   2) [**Kohler Co**]
   3) [**Mansfield Plumbing Products LLC**]
   4) [**ProFlo; a Ferguson Enterprises, Inc. brand**]
   5) [**Sloan Valve Company**]
   6) [**Zurn Industries, LLC**]
   7) <**Insert manufacturer's name**>
b. Source Limitations: Obtain water closets from single source from single manufacturer.
c. Standard: ASME A112.19.2/CSA B45.1
d. Bowl:
   1) Material: Vitreous china.
   2) Type: Siphon jet.
   3) Style: Flushometer valve.
   4) Height: [**Standard**][**Accessible in accordance with ICC A117.1**].
   5) Rim Contour: Elongated.
   6) Water Consumption: [1.1 gal.][1.28 gal.][1.6 gal.][**Dual flush** 1.1 gal./1.28 gal.][**Dual flush** 1.1 gal./1.6 gal.] per flush.
   7) Spud Size and Location: NPS 1-1/2; top.
   8) Color: [**White**]<**Insert color**>.
e. Flushometer Valve: <**Insert flushometer-valve designation**>.
f. Toilet Seat: <**Insert toilet-seat designation**>.
g. Support: [**Water-closet carrier, floor affixed**]<**Insert carrier**>.

B. Water Closets, Wall Mounted:
1. Water Closets, Wall Mounted - Top Spud:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) American Standard
      2) Kohler Co
      3) TOTO USA, INC
   b. Source Limitations: Obtain water closets from single source from single manufacturer.
   c. Standard: ASME A112.19.2/CSA B45.1.
   d. Bowl:
      1) Material: Vitreous china.
      2) Type: Siphon jet.
      3) Style: Flushometer valve.
      4) Mounting Height: As indicated on drawings.
      5) Rim Contour: Elongated.
      6) Water Consumption: 1.28 gal. per flush.
      7) Spud Size and Location: NPS 1-1/2; top.
      8) Color: White.
   e. Flushometer Valve: As scheduled.
   f. Toilet Seat: As scheduled.
   g. Support: Water-closet carrier, floor affixed.

2.6 FLUSHOMETER VALVES

A. Flushometer Valves, Manually Operated:
1. Flushometer Valves, Manually Operated - Diaphragm, Lever Handle:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Sloan Valve Company
      2) Zurn Industries, LLC

b. Source Limitations: Obtain flushometer valve from single source from single manufacturer.
c. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
d. Minimum Pressure Rating: 125 psig.
e. Features: Include integral check stop and backflow-prevention device.
f. Material: Brass body with corrosion-resistant components.
g. Style: Exposed.
h. Flushometer-Valve Finish: Chrome-plated.
i. Handle Finish: Chrome plated.
j. Consumption:
    1) Urinals: 0.125 gallons per flush
    2) Water Closets: 1.28 gallons per flush
k. Minimum Inlet:
    1) Urinals: NPS 3/4
    2) Water Closets: NPS 1
l. Minimum Outlet:
    1) Urinals: NPA 3/4
    2) Water Closets: NPS 1-1/4

2. Flushometer Valves, Manually Operated - Piston, Lever Handle:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1) Sloan Valve Company
    2) TOTO USA, INC
    3) Zurn Industries, LLC
b. Source Limitations: Obtain flushometer valve from single source from single manufacturer.
c. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
d. Minimum Pressure Rating: 125 psig.
e. Features: Include integral check stop and backflow-prevention device.
f. Material: Brass body with corrosion-resistant components.
g. Style: Exposed.
h. Flushometer-Valve Finish: Chrome-plated.
i. Handle Finish: Chrome-plated.
j. Consumption:
    1) Urinals: 0.125 gallons per flush
    2) Water Closets: 1.28 gallons per flush
k. Minimum Inlet:
    1) Urinals: NPS 3/4
    2) Water Closets: NPS 1
l. Minimum Outlet:
    1) Urinals: NPS 3/4
    2) Water Closets: NPS 1-1/4

2.7 TOILET SEATS

A. Toilet Seats - Commercial:
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 Standard
    b. Bemis Manufacturing Company
    c. Church Seats; Bemis Manufacturing Company
    d. Kohler Co
    e. TOTO USA, INC
2. Source Limitations: Obtain toilet seats from single source from single manufacturer.
3. Standard: IAPMO/ANSI Z124.5.
4. Material: Plastic.
5. Type: Commercial (heavy duty).
6. Shape: Elongated rim, open or closed front as scheduled.
7. Hinge: Check.

8. Hinge Material: Noncorroding metal.
9. Seat Cover:As scheduled.
10. Color: White.
11. Surface Treatment: Antimicrobial.

2.8 FIXTURE CARRIERS

A. Fixture Carriers - Lavatory:
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.
   b. Josam Company
   c. MIFAB, Inc
   d. Wade; a subsidiary of McWane Inc.
   e. WATTS; A Watts Water Technologies Company
   f. Zurn Industries, LLC
2. Source Limitations: Obtain lavatory carriers from single source from single manufacturer.
3. Standards:
   a. ASME A112.6.1M.
   b. ASME A112.6.2.

B. Fixture Carriers - Sink:
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. Jay R. Smith Mfg Co; a division of Morris Group International
   b. Josam Company
   c. MIFAB, Inc
   d. Wade; a subsidiary of McWane Inc.
   e. WATTS; A Watts Water Technologies Company
   f. Zurn Industries, LLC
2. Source Limitations: Obtain sink carriers from single source from single manufacturer.
3. Standards:
   a. ASME A112.6.1M.
   b. ASME A112.6.2.

C. Fixture Carriers - Urinal:
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. Jay R. Smith Mfg Co; a division of Morris Group International
   b. Josam Company
   c. MIFAB, Inc
   d. Wade; a subsidiary of McWane Inc.
   e. WATTS; A Watts Water Technologies Company
   f. Zurn Industries, LLC
2. Source Limitations: Obtain urinal carriers from single source from single manufacturer.
3. Standard: ASME A112.6.1M.
4. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings, gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

D. Fixture Carriers - Water Closet:
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. Jay R. Smith Mfg Co; a division of Morris Group International
   b. MIFAB, Inc
   c. Wade; a subsidiary of McWane Inc.
   d. WATTS; A Watts Water Technologies Company
   e. Zurn Industries, LLC

2. Source Limitations: Obtain water closet carriers from single source from single manufacturer.
3. Standard: ASME A112.6.1M.
4. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings, gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine walls and floors for suitable conditions where plumbing fixtures will be installed.

C. Examine counters for suitable conditions where lavatories and sinks will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF COMMERCIAL PLUMBING FIXTURES

A. Lavatory Installation:
1. Install lavatories level and plumb in accordance with roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted lavatories.
3. Install accessible, wall-mounted lavatories at mounting height in accordance with ICC A117.1.
4. Install water-supply piping with stop on each supply to each lavatory faucet. Install stops in locations that are accessible for ease of operation.
5. Install trap and waste piping on each drain outlet of each lavatory to be connected to sanitary drainage system.
6. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
7. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section "Joint Sealants."
8. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

B. Sink Installation:
1. Install sinks level and plumb in accordance with roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted sinks.
3. Install accessible, wall-mounted sinks at mounting height in accordance with ICC A117.1.
4. Set floor-mounted sinks in leveling bed of cement grout.
5. Install water-supply piping with stop on each supply to each sink faucet.
    a. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping."
    b. Install stops/valves in locations that are accessible for ease of operation.
6. Install trap and waste piping on each drain outlet of each sink to be connected to sanitary drainage system.
7. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
8. Seal joints between sinks, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
9. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

C. Urinal Installation:
1. Install urinals level and plumb in accordance with roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste-fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height in accordance with ICC A117.1.
4. Install supports, affixed to building substrate, for wall-hung urinals.
5. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
6. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
7. Measure support height installation from finished floor, not structural floor.
8. Install flushometer-valve, water-supply fitting on each supply to each urinal.
9. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
10. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
11. Install actuators in locations easily reachable for people with disabilities.
12. Install new batteries in battery-powered, electronic-sensor mechanisms.
13. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
14. Seal joints between urinals, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to urinal color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

D. Water Closet Installation:
1. Install water closets level and plumb in accordance with roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height in accordance with ICC A117.1.
4. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
5. Use carrier supports with waste-fitting assembly and seal.
6. Install floor-mounted, back-outlet water closets, attached to building floor substrate, onto waste-fitting seals; and attach to support.
7. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals, and affix to building substrate.
8. Measure support height installation from finished floor, not structural floor.
9. Install flushometer-valve, water-supply fitting on each supply to each water closet.
10. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
11. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
12. Install actuators in locations easily reachable for people with disabilities.
13. Install new batteries in battery-powered, electronic-sensor mechanisms.
14. Install toilet seats on water closets.
15. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
16. Seal joints between water closets, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to water-closet color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 INSTALLATION OF PIPING CONNECTIONS

A. Connect plumbing fixtures with water supplies and soil, waste, and vent piping. Use size fittings required to match plumbing fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil, waste, and vent piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective-shielding pipe covers and enclosures on exposed supplies and waste piping of accessible plumbing fixtures. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

E. Where installing piping adjacent to water closets and urinals, allow space for service and maintenance.

3.4 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.

3.5 INSTALLATION OF CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.6 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning plumbing fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Adjust water pressure at flushometer valves to produce proper flow.

D. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.7 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damage to finishes. Replace any fixtures unable to be repaired to the satisfaction of the Architect.

B. Clean plumbing fixtures and associated faucets, valves, flushometer valves, and fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and associated faucets, valves, flushometer valves, and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Motors.
   2. Sleeves without waterstop.
   3. Grout.
   4. Silicone sealants.
   5. Escutcheons.
   6. Refrigerant pipe wall penetration assemblies

B. Related Requirements:
   1. Section 231123 "Facility Natural-Gas Piping" for gas meters.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. For each type of product, excluding motors which are included in Part 1 of HVAC equipment Sections.
      a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
      b. Include operating characteristics and furnished accessories.

PART 2 - PRODUCTS

2.1 MOTORS

A. Motor Requirements, General:
   1. Content includes motors for use on alternating-current power systems of up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
   2. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
   3. Comply with NEMA MG 1 unless otherwise indicated.
   4. Comply with IEEE 841 for severe-duty motors.

B. Motor Characteristics:
   1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 ft. above sea level.
   2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Polyphase Motors:
   1. Description: NEMA MG 1, Design B, medium induction motor.
   2. Efficiency: Premium Efficient, as defined in NEMA MG 1.
   3. Service Factor: 1.15.
   4. Multispeed Motors: Variable torque.
      a. For motors with 2:1 speed ratio, consequent pole, single winding.
      b. For motors with other than 2:1 speed ratio, separate winding for each speed.
   5. Multispeed Motors, Two Winding: Separate winding for each speed.
   6. Rotor: Random-wound, squirrel cage.
   7. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
   8. Temperature Rise: Match insulation rating.
   9. Insulation: Class F.
   10. Code Letter Designation:

a. Motors 15 Hp and Larger: NEMA starting Code F or Code G.
b. Motors Smaller Than 15 Hp: Manufacturer's standard starting characteristic.

11. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Additional Requirements for Polyphase Motors:
1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time-rise pulses produced by pulse-width-modulated inverters.
b. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:
1. Motors larger than 1/20 hp must be one of the following, to suit starting torque and requirements of specific motor application:
a. Permanent-split capacitor.
b. Split phase.
c. Capacitor start, inductor run.
d. Capacitor start, capacitor run.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 hp and Smaller: Shaded-pole type.
5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device will automatically reset when motor temperature returns to normal range.

F. Electronically Commutated Motors:
1. Microprocessor-Based Electronic Control Module: Converts 120 V or 240 V single-phase AC power to three-phase DC power to operate the brushless DC motor.
2. Three-phase power motor module with permanent magnet rotor.
3. Circuit board or digital speed controller/LED display.
4. Building Automation System Interface: Via DC voltage signal or Digital Serial Interface (DSI).

2.2 SLEEVES AND SLEEVE SEALS

A. Sleeves without Waterstop:
1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
2. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
3. Steel Sheet Sleeves: ASTM A653/A653M, **24 gauge** minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.
4. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
5. Molded-PVC Sleeves: With nailing flange.
6. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange.

B. Grout:
1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

C. Silicone Sealants:
1. Silicone Sealant, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.
a. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.3 ESCUTCHEONS

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. BrassCraft Manufacturing Co.; a Masco company
2. Dearborn Brass
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The)
5. Mid-America Fittings, LLC; A Midland Industries Company
6. ProFlo; a Ferguson Enterprises, Inc. brand

B. Escutcheon Types:
1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Stainless Steel Type: With polished stainless steel finish.
3. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

C. Floor Plates:
1. Split Floor Plates: Steel with concealed hinge.

2.4 Refrigerant Piping Wall Penetration Assemblies

A. Basis of Design Product: Subject to compliance with requirements, provide Airex Manufacturing Inc. Titan Outlet, or comparable product approved by Engineer. Field fabricated assemblies will not be accepted in lieu of manufactured assembly.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout or silicone sealant, seal space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

3.2 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using grout or silicone sealant, seal space around outside of sleeves.

3.3 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.5 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:
1. Perform the following tests and inspections:
   a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
   b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
2. Prepare test and inspection reports.

B. Escutcheons:
1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.6 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Concrete Slabs-on-Grade:
   a. Sleeves with waterstops.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
2. Interior Walls and Partitions:
   a. Sleeves without waterstops.

3.7 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping and Relocated Existing Piping:
1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Chrome-Plated Piping: One piece, steel or split-plate steel with polished, chrome-plated finish.
3. Insulated Piping:

a. One piece, steel with polished, chrome-plated finish.

4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
   a. One piece, steel with polished, chrome-plated finish.
5. Bare Piping at Ceiling Penetrations in Finished Spaces:
   a. One piece, steel with polished, chrome-plated finish.
6. Bare Piping in Unfinished Service Spaces:
   a. One piece, steel with polished, chrome-plated finish.
7. Bare Piping in Equipment Rooms:
   a. One piece, steel with polished, chrome-plated finish.

B. Install floor plates for piping penetrations of equipment-room floors.

C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

END OF SECTION 230500

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports - carbon steel.
2. Pipe hangers and supports - stainless steel.
3. Pipe/tube hangers and supports - copper.
4. Pipe hangers - metal, trapeze type.
5. Strut support system - metal, rod type.
6. Strut support system - metal, cable type.
7. Thermal hanger shield inserts.
8. Fastener system - mechanical expansion anchors.
9. Equipment supports.
10. Equipment stands - outdoor type.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment are to withstand the effects of gravity loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 PIPE HANGERS AND SUPPORTS - METAL

A. Pipe Hangers and Supports - Carbon Steel:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washers made of carbon steel.

B. Pipe Hangers and Supports - Stainless Steel:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Pipe/Tube Hangers and Supports - Copper:
1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 PIPE HANGERS - METAL, TRAPEZE TYPE

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 STRUT SUPPORT SYSTEMS - METAL

A. Strut Support System - Metal, Rod Type:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CADDY; brand of nVent Electrical plc
   b. Cooper B-line; brand of Eaton, Electrical Sector
   c. Flex-Strut Inc.
   d. G-Strut
2. Description: Factory-fabricated pipe-support assembly made of steel channels, vertical metal support rods, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Struts: Continuous slotted carbon-steel channel with inturned lips.
5. Strut Width: Selected for applicable load criteria.
6. Strut Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
8. Metallic Coating: Electroplated zinc.
9. Paint Coating: Green epoxy, acrylic, or urethane.

2.5 THERMAL HANGER SHIELD INSERTS

A. Thermal Hanger Shield Inserts:
1. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100 psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psi minimum compressive strength and vapor barrier.
2. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100 psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psi minimum compressive strength.
3. For Trapeze or Clamped Systems: Insert and shield are to cover entire circumference of pipe.
4. For Clevis or Band Hangers: Insert and shield are to cover bottom 180 degrees of pipe.
5. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Fastener System - Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities required for supported loads and building materials where used.
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. Cooper B-line; brand of Eaton, Electrical Sector
   b. Empire Industries, Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
   e. MKT Fastening, LLC
2. Indoor Applications: Zinc-plated or stainless steel.
3. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 EQUIPMENT STANDS, OUTDOOR TYPE

A. Equipment Stands, Outdoor Type:
   1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
      a. DiversiTech Corp.
      b. MIRO Industries Inc.
      c. RectorSeal HVAC; a CSW Industrials Company
      d. nVent Caddy
   2. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground- or roof-supported outdoor equipment components, without roof membrane penetration, in a prefabricated system that can be modularly assembled on site.
   3. Foot Material: Rubber or polypropylene.
   4. Rails Material: Hot dip galvanized carbon steel.
   5. Wind/Sliding Load Resistance: Up to 100 mph minimum.

2.9 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000 psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry static loads within specified loading limits. Minimum static design load used for strength determination is to include weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. 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.

B. Install lateral bracing with pipe hangers and supports to prevent swaying.

C. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping. Coordinate location of concrete inserts before concrete is placed.

D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

F. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Thermal hanger shield inserts may be used as an option. 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 are to span an arc of 180 degrees.
      a. Thermal hanger shield inserts may be used as an option. 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 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
      b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
      c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.
      d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
      e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.
   5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

G. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

H. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate in accordance with ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel in accordance with AWS D1.1/D1.1M.

I. Strut System Installation: Metal, rod type. Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.

J. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

K. Fastener System Installation:
   1. Install mechanical-expansion anchors after concrete is placed and completely cured.
   2. Install fasteners in accordance with manufacturer's written instructions.
   3. Install lag screw wood fasteners in accordance with manufacturer's written instructions.

L. Pipe Stand Installation:
   1. Pipe Stand Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

M. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

N. Equipment Support Installation:
   1. Fabricate from welded-structural-steel shapes.
   2. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
   3. Grouting: Place grout under supports for floor-mounted equipment, and make bearing surface smooth.
   4. Provide lateral bracing, to prevent swaying.

3.3 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.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; methods used in correcting welding work; and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 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.

3.5 PAINTING

A. Touchup:
   1. 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.
      a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
   2. Comply with requirements in Other Section(s) for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
   3. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   6. C-Clamps (MSS Type 23): For structural shapes.
   7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
   9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
   10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
   11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
   12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
      a. Light (MSS Type 31): 750 lb.
      b. Medium (MSS Type 32): 1500 lb.
      c. Heavy (MSS Type 33): 3000 lb.
   13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
   15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal Hanger Shield Inserts: For supporting insulated pipe.

N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:
   1. TAB of Air Systems:
      a. Constant-volume air systems.
   2. TAB of equipment.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NC: Noise criteria.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in "Examination" Article, if issues are discovered that may preclude the proper testing and balancing of the systems. Submit a summary report of the examination review required in "Examination" Article.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article, to be used and filled out by systems installers verifying that systems are ready for TAB.

E. Certified TAB Reports: Within 14 days of completion of testing and balancing work.

F. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration and calibration interval.

1.4 QUALITY ASSURANCE

A. TAB Specialist Firm's Qualifications: Certified by NEBB or TABB.
   1. TAB Certified Professional: Employee of the TAB specialist firm and certified by NEBB or TABB.
   2. TAB Technician: Employee of the TAB specialist firm and certified by NEBB or TABB.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in system designs that may preclude proper TAB of systems and equipment. Submit Contract Documents Examination Report summary of findings.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for TAB.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

E. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean and permanent filters are installed, and equipment with functioning controls is ready for operation.

F. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning as indicated on Drawings or in the Specifications.

G. Observe demonstration of operating safety interlocks and controls on HVAC equipment.

H. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.

B. Prepare system-readiness checklists of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
   1. Airside:
      a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
      b. Duct systems are complete with terminals installed.
      c. Volume, smoke, and fire dampers are open and functional.
      d. Clean filters are installed.
      e. Fans are operating, free of vibration, and rotating in correct direction.
      f. Variable-frequency controllers' startup is complete and safeties are verified.
      g. Automatic temperature-control systems are operational.
      h. Ceilings are installed.
      i. Windows and doors are installed and are in normal operating positions.
      j. Note location of balancing devices that are inaccessible.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
   1. Installing Contractor to Perform the Following:
      a. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

b. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
c. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
d. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation," and Section 230719 "HVAC Piping Insulation."

B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

C. Take and report testing and balancing measurements in inch-pound (IP) units.

D. 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.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
1. Motors.
2. Fans and ventilators.
3. Unit heaters.
4. Energy-recovery units.
5. Dedicated outdoor-air units.
6. Split-system air conditioners.
7. Variable-refrigerant-flow systems.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare single-line schematic diagram of systems or color-coded HVAC drawings for the purpose of identifying HVAC components, including each air terminal unit and each air diffuser, register, and grille.

C. For variable-air-volume systems, develop a plan to simulate diversity and include in TAB plan.

D. Determine suitable locations in main and branch ducts for accurate duct-airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.

F. Verify that motor controllers are equipped with properly sized thermal protection.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
1. Measure total airflow.
a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
2. Measure fan static pressures as follows:
a. Measure static pressure directly at the fan outlet.
b. Measure static pressure directly at the fan inlet.
c. Measure static pressure differential across each component that makes up the air-handling system.

d. Apply artificial loading of filters to simulate a dirty filter pressure drop condition at the time static pressures are measured.

3. Obtain approval from [**Architect**][**Owner**][**Construction Manager**][**Commissioning Authority**] for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all volume dampers have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets' and outlets' airflow. Apply correction factors as applicable for each size and style of air device.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design range. Readjust to within design tolerance if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Traverse the supply airflow in full airside economizer mode. Observe the mixed air plenum pressure as compared to normal operation: return air dampers open and minimum outside air varying to 100 percent outside air dampers fully open and return air dampers fully closed. Mixed air pressure is to remain constant plus/minus 20 percent or, otherwise, damper/fan adjustments will be required.
5. Mark all final settings.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors: 1/2 hp and larger; test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation. Verify and report Hz at maximum and minimum flows.

3.8 TOLERANCES

A. Set HVAC system's airflow rates and water-flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent. If design value is less than 100 cfm, flow rate is within 10 cfm.
2. Air Outlets and Inlets: Plus or minus 10 percent. If design value is less than 100 cfm, flow rate is within 10 cfm.

B. Maintaining pressure relationships as designed is to have priority over the tolerances specified above. If the above tolerances change the relative positive or negative airflow from/into the space, tolerances are to be adjusted so as to keep the relative positive cfm or negative cfm from/into the space a constant cfm differential.

3.9 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.

3.10 FINAL TESTING AND BALANCING REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.
   3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB specialist firm and technician.
   3. Project name.
   4. Project location.
   5. Project Architect's name, firm, and address.
   6. Project engineer's name, firm, and address.
   7. Project Contractor's name, firm, and address.
   8. Report date.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents, including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fan performance forms, including the following:
      a. Settings for outdoor-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Heating coil, dry-bulb conditions.
      e. Face and bypass damper settings at coils.
      f. Fan drive settings, including settings and percentage of maximum pitch diameter.
      g. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Duct, outlet, and inlet sizes.

E. Air-Terminal-Device Reports:
   1. Unit Data:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Apparatus used for test.
      d. Area served.
      e. Make.
      f. Number from system diagram.
      g. Type and model number.
      h. Size.
   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.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.

B. Related Requirements:
   1. Section 230719 "HVAC Piping Insulation."
   2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
   3. Detail application of field-applied jackets.
   4. Detail application at linkages of control devices.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers are to be marked with the manufacturer's name, appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.4 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.5 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule" article for where insulating materials are to be applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed; SAINT-GOBAIN
      b. Johns Manville; a Berkshire Hathaway company
      c. Knauf Insulation
      d. Manson Insulation Inc.
      e. Owens Corning

2.3 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products
      b. Eagle Bridges - Marathon Industries
      c. Foster Brand; H. B. Fuller
      d. Mon-Eco Industries, Inc.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products
      b. Eagle Bridges - Marathon Industries
      c. Foster Brand; H. B. Fuller
      d. Mon-Eco Industries, Inc.

2.4 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.
   1. VOC Content: [**300**]<**Insert value**> g/L or less.

B. Vapor-Retarder Mastic, Water Based, Interior Use: Suitable for indoor use on below ambient services.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Aeroflex USA
      b. Childers Brand; H. B. Fuller Construction Products
      c. Foster Brand; H. B. Fuller
      d. Knauf Insulation
   2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Exterior Use: Suitable for outdoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Aeroflex USA
    b. Childers Brand; H. B. Fuller Construction Products
    c. Eagle Bridges - Marathon Industries
    d. Foster Brand; H. B. Fuller
2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Childers Brand; H. B. Fuller Construction Products
    b. Eagle Bridges - Marathon Industries
    c. Foster Brand; H. B. Fuller
    d. Knauf Insulation
    e. Mon-Eco Industries, Inc.
2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Childers Brand; H. B. Fuller Construction Products
    b. Eagle Bridges - Marathon Industries
    c. Foster Brand; H. B. Fuller
    d. Mon-Eco Industries, Inc.
2. Materials are 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.

B. ASJ Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Childers Brand; H. B. Fuller Construction Products
    b. Foster Brand; H. B. Fuller
2. Materials are compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Industrial Adhesives and Tapes Division
      b. Aeroflex USA
      c. Avery Dennison Corporation, Specialty Tapes Division
      d. Ideal Tape Co., Inc., an American Biltrite Company
      e. Knauf Insulation
   2. Width: 3 inches.
   3. Thickness: 11.5 mils.
   4. Adhesion: 90 ounces force/inch in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Industrial Adhesives and Tapes Division
      b. Avery Dennison Corporation, Specialty Tapes Division
      c. Ideal Tape Co., Inc., an American Biltrite Company
      d. Knauf Insulation
   2. Width: 3 inches.
   3. Thickness: 6.5 mils.
   4. Adhesion: 90 ounces force/inch in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.8 SECUREMENTS

A. Bands:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; a Berkshire Hathaway company
      b. RPR Products, Inc.
   2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
   3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
   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. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents, unless otherwise approved by the engineer-of-record.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

D. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Comply with manufacturer's written installation instructions and ASTM C1710.

B. 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.

C. Square and Rectangular Ducts and Plenums:
   1. Provide 1/4 inch more per side for a tight, compression fit.
   2. Cut sheet insulation with the following dimensions:
      a. Width of duct plus 1/4 inch, one piece.
      b. Height of duct plus 1/4 inch, plus thickness of insulation, two pieces.
      c. Width of duct plus 1/4 inch, plus two times the thickness of insulation, one piece.
   3. Insulate the bottom of the duct with the sheet from (a) above, then the sides with the two sheets from (b) above, and finally the top of the duct with the sheet from (c) above.
   4. Insulation without self-adhering backing:
      a. Apply 100 percent coverage of manufacturer adhesive on the metal surface, then the insulation, except for the last 1/4 inch where sheets will butt together.
      b. Roll sheet down into position.
      c. Press two sheets together under compression and apply adhesive at the butt joint to seal the two sheets together.
   5. Insulation with self-adhering backing:
      a. Peel back release paper in 6- to 8-inch increments and line up sheet.
      b. Press firmly to activate adhesive.
      c. Align material and continue to line up correctly, pressing firmly while slowly removing release paper.
      d. Allow 1/4-inch overlap for compression at butt joints.
      e. Apply adhesive at the butt joint to seal the two sheets together.
   6. Insulate duct brackets following manufacturer's written installation instructions.

D. Circular Ducts:
   1. Determine the circumference of the duct, using a strip of insulation the same thickness as to be used.
   2. Cut the sheet to the required size.

3. Apply 100 percent coverage of manufacturer adhesive on the metal surface then the insulation.
4. Apply manufacturer adhesive to the cut surfaces along 100 percent of the longitudinal seam. Press together the seam at the ends and then the middle. Close the entire seam starting from the middle.

3.6 INSTALLATION OF GLASS-FIBER INSULATION

A. Comply with manufacturer's written installation instructions.
1. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
2. 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.
3. 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.
4. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Definitions:
1. Supply air ducts shall be ducts conveying air that has been heated or cooled for space conditioning purposes. Discharge ducts from dedicated outside air units shall be considered supply air ducts.
2. Outdoor air ducts shall be ducts conveying untreated outside air.
3. Return air ducts shall be ducts conveying room temperature air from conditioned spaces to the return side of air handling equipment, to be recirculated.
4. Exhaust ducts shall be ducts conveying room temperature air from conditioned spaces to be discharged to the exterior.

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 unconditioned space.
4. Indoor, exposed return located in unconditioned 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.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. 1.5 lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, outdoor-air duct insulation is one of the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

C. Concealed, rectangular, supply-air duct insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

D. Concealed, rectangular, return-air duct insulation in unconditioned space is the following:
   1. Glass-Fiber Blanket: 3 inches thick and 0.75 lb/cu. ft. nominal density.

E. Concealed, rectangular, outdoor-air duct insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

F. Concealed, supply-air plenum insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

G. Concealed, outdoor-air plenum insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

H. Exposed, round and flat-oval, supply-air duct insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

I. Exposed, round and flat-oval, outdoor-air duct insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

J. Exposed, rectangular, supply-air duct insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

K. Exposed, rectangular, outdoor-air duct insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

L. Exposed, supply-air plenum insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

M. Exposed, outdoor-air plenum insulation is the following:
   1. Glass-Fiber Blanket: 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.

B. Related Requirements:
   1. Section 230713 "Duct Insulation" for duct insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size[**, as well as ASTM standard designation, and maximum use temperature**].

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authority having jurisdiction.

Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.

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. Owens Corning
2. Preformed Pipe Insulation without Jacket: Type II, Class 1, unfaced.
3. Preformed Pipe Insulation with Jacket: Type II, Class 2, with factory-applied ASJ jacket.
4. Fabricated shapes in accordance with ASTM C450, ASTM C585, and ASTM C1639.
5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

D. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I, for tubular materials, Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA
   b. Armacell LLC
   c. K-Flex USA

E. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.

1. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
2. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.

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. Ramco Insulation, Inc.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Foster Brand; H. B. Fuller

C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA

b. Armacell LLC
c. K-Flex USA

2. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
3. Wet Flash Point: Below 0 deg F.
4. Service Temperature Range: 40 to 200 deg F.
5. Color: Black.

D. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Childers Brand; H. B. Fuller Construction Products
b. Foster Brand; H. B. Fuller
c. Mon-Eco Industries, Inc.

E. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Childers Brand; H. B. Fuller Construction Products
b. Foster Brand; H. B. Fuller
c. Mon-Eco Industries, Inc.

F. PVC Jacket Adhesive: Compatible with PVC jacket.
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. Johns Manville; a Berkshire Hathaway company
b. P.I.C. Plastics, Inc.
c. Proto Corporation
d. Sekisui Voltek, LLC
e. Speedline Corporation
f. The Dow Chemical Company

2.5 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Childers Brand; H. B. Fuller Construction Products
b. Foster Brand; H. B. Fuller
c. Mon-Eco Industries, Inc.
d. Owens Corning
2. Permanently flexible, elastomeric sealant.
a. Service Temperature Range: Minus 150 to plus 250 deg F.
b. Color: White or gray.

C. FSK and Metal Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Childers Brand; H. B. Fuller Construction Products
b. Foster Brand; H. B. Fuller
c. Mon-Eco Industries, Inc.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

D. ASJ Flashing Sealants and PVDC and PVC Jacket Flashing Sealants:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Childers Brand; H. B. Fuller Construction Products
      b. Foster Brand; H. B. Fuller
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
   4. ASJ+: Aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM C1136, Types I, II, III, IV, and VII.
   5. PSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. 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. Airex Manufacturing Inc.
      b. Johns Manville; a Berkshire Hathaway company
      c. P.I.C. Plastics, Inc.
      d. Proto Corporation
      e. Speedline Corporation
   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.

D. Metal Jacket:
   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. Johns Manville; a Berkshire Hathaway company
      b. RPR Products, Inc.
   2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
      a. Factory cut and rolled to size.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
      d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. 3M Industrial Adhesives and Tapes Division
b. Aeroflex USA
c. Avery Dennison Corporation, Specialty Tapes Division
d. Ideal Tape Co., Inc., an American Biltrite Company
e. Knauf Insulation
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. 3M Industrial Adhesives and Tapes Division
b. Avery Dennison Corporation, Specialty Tapes Division
c. Ideal Tape Co., Inc., an American Biltrite Company
d. Knauf Insulation
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. 3M Industrial Adhesives and Tapes Division
b. Ideal Tape Co., Inc., an American Biltrite Company
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
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 Industrial Adhesives and Tapes Division
b. Avery Dennison Corporation, Specialty Tapes Division
c. Ideal Tape Co., Inc., an American Biltrite Company
d. Knauf Insulation

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents[**, unless otherwise approved by the engineer of record**].

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
   3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
   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.
   4. For below-ambient services, apply vapor-barrier mastic over staples.
   5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
   6. 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.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

F. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using prefabricated fitting insulation made from same material and density as that of adjacent pipe insulation. Each piece is 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 prefabricated fitting insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using prefabricated fitting insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
   6. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
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 prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
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 prefabricated valve covers manufactured of same material as that of pipe insulation when available.

2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:
1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap 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.

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in other sections.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Refrigerant Suction and Hot-Gas Piping:
   1. All Pipe Sizes: Insulation is the following:
      a. Flexible Elastomeric: 1 inch thick.

C. Refrigerant Liquid Piping:
   1. All Pipe Sizes: Insulation is the following:
      a. Flexible Elastomeric: 1 inch thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:
   1. All Pipe Sizes: Insulation is one of the following:
      a. Flexible Elastomeric: 2 inches thick.

B. Refrigerant Liquid Piping:
   1. All Pipe Sizes: Insulation is the following:
      a. Flexible Elastomeric: 2 inches thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. PVC: 20 mils thick.
   2. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 230719

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SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipes, tubes, and fittings.
   2. Manual gas shutoff valves.
   3. Pressure regulators.
   4. Dielectric fittings.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. An example includes rooftop locations.

C. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Piping specialties.
   2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
   3. Pressure regulators. Indicate pressure ratings and capacities.
   4. Dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with the ASME Boiler and Pressure Vessel Code.

1.6 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 and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.7 COORDINATION

A. Coordinate requirements for piping identification for natural-gas piping. Comply with requirements in Section 220553 "Identification of Plumbing Piping and Equipment."

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each product type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Comply with the International Fuel Gas Code.

B. Minimum Operating-Pressure Ratings:
   1. Piping and Valves: 100 psig minimum unless otherwise indicated.

C. Natural-Gas System Pressure within Buildings:
   1. Single Pressure: More than 0.5 psig, but not more than 2 psig.

2.3 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum O-rings, and spiral-wound metal gaskets.
      e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
   5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
      a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.4 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: 24 inches.

2.5 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.

2.6 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves NPS 1-1/4 to NPS 2 having initials "WOG" permanently marked on valve body.

B. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A.Y. McDonald Mfg. Co.
   b. Lee Brass Company
2. Body: Bronze, complying with ASTM B584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.7 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A.Y. McDonald Mfg. Co.
   b. Capitol Manufacturing Company
   c. GF Piping Systems: Georg Fischer LLC
   d. HART Industrial Unions, LLC
   e. Jomar Valve
   f. Matco-Norca
   g. WATTS; A Watts Water Technologies Company
   h. Wilkins
   i. Zurn Industries, LLC
2. Description:
   a. Standard: ASSE 1079.
   b. Pressure Rating: 125 psig minimum at 180 deg F.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

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 in accordance with the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for preventing accidental ignition.

3.3 INSTALLATION OF OUTDOOR PIPING

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install fittings for changes in direction and branch connections.

3.4 INSTALLATION OF INDOOR PIPING

A. Comply with 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. Do not install piping in concealed locations unless sleeved with the sleeve open at both ends.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Where installing piping above accessible ceilings, allow sufficient space for ceiling panel removal.

G. Locate valves for easy access. Do not locate valves within return air plenums.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Verify final equipment locations for roughing-in.

K. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

L. 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.

M. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
   1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
   2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
   3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
   4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
      a. Exception: Tubing passing through partitions or walls does not require striker barriers.
   5. Prohibited Locations:
      a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

b. Do not install natural-gas piping in solid walls or partitions.

N. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

O. Connect branch piping from top or side of horizontal piping.

P. 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.

Q. Do not use natural-gas piping as grounding electrode.

R. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.5 INSTALLATION OF VALVES

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless steel tubing, aluminum, or copper connector.

B. Do not install valves in return-air plenums.

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 in accordance with AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

B. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for corrugated stainless steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of corrugated stainless steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 PIPING CONNECTIONS

A. Connect to utility's gas meter and pressure regulator according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas-appliance equipment grounding conductor of the circuit powering the appliance in accordance with NFPA 70.

C. Where installing piping adjacent to appliances, allow space for service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

3.9 LABELING AND IDENTIFICATION

3.10 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Test, inspect, and purge natural gas in accordance with the International Fuel Gas Code and authorities having jurisdiction.
   2. Natural-gas piping will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

3.11 OUTDOOR PIPING SCHEDULE

A. Aboveground natural-gas piping is to be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

A. Aboveground, branch piping NPS 1 and smaller is to be the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping NPS 1 ¼ and larger is to be the following:
   1. Steel pipe with wrought-steel fittings and welded joints.

3.13 ABOVEGROUND, MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller are to be the following:
   1. Bronze plug valve.

B. Valves in branch piping for single appliance are to be the following:
   1. Bronze plug valve.

END OF SECTION 231123

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Copper tube and fittings.
   2. Steel pipe and fittings.
   3. Valves and specialties.
   4. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Submit data for each type of refrigerant piping, fitting, valve, piping specialty, and refrigerant.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

B. Prepare valves and specialties for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads and other end connections.

C. Use the following precautions during storage:
   1. Maintain valve and specialty end protection.
   2. Store valves and specialties indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASHRAE 15 and ASHRAE 34.

B. Comply with ASME B31.5.

C. Test Pressure for Refrigerant R-410A:
   1. As required by VRF system manufacturer.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B280, Type ACR.

B. Wrought-Copper Fittings, Brazed Joint: ASME B16.50.

C. Brazing Filler Metals: AWS A5.8M/A5.8.

2.3 REFRIGERANTS

A. R-454B, ASHRAE 34: R-32 (68.9 percent by mass) and R-1234yf (31.1 percent by mass).
   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. Arkema Inc.
      b. Honeywell International Inc.
      c. Mexichem Fluor, Inc. (Koura)
      d. The Chemours Company

PART 3 - EXECUTION

3.1 PIPING APPLICATION SCHEDULES

A. Refrigerant: R-454B.

B. Suction, Hot-Gas, and Liquid Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

3.2 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping in accordance with ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.3 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Brazed Joints: Construct joints in accordance with AWS BRH, "Brazing Handbook," Ch. 35, "Pipe and Tubing."
   1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal runs less than 20 ft. long.
   2. Roller hangers and spring hangers for individual horizontal runs 20 ft. or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 ft. or longer, supported on a trapeze.
   4. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 SYSTEM CHARGING

A. Charge system usingprocedures as required by equipment manufacturer. If manufacturer has no charging recommendations, the following procedure shall apply:
   1. Install core in filter dryers after leak test but before evacuation.
   2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
   3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
   4. Charge system with a new filter-dryer core in charging line.

END OF SECTION 232300

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SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rectangular ducts and fittings - single wall.
   2. Round ducts and fittings - single wall.
   3. Round ducts and fittings - double wall.
   4. Sheet metal materials.
   5. Duct liner.
   6. Hangers and supports.
   7. Strut support system for ductwork - metal, cable type.

B. Related Requirements:
   1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 DEFINITIONS

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.

B. Shop Drawings:
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   4. Elevation of top and bottom of ducts.
   5. Dimensions of all duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.
   8. Seam and joint construction.
   9. Penetrations through fire-rated and other partitions.
   10. Equipment installation based on equipment being used on Project.
   11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
   12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

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, 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 are to 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 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 RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts and Fittings - Single Wall:
   1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on static-pressure class indicated on the Drawings.
      a. Construct ducts of galvanized sheet steel.
   2. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
      a. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
      b. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
   3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   4. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 ROUND DUCTS AND FITTINGS

A. Round Ducts and Fittings - Single Wall:
   1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class indicated on the Drawings.
      a. Construct ducts of galvanized sheet steel.
   2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Round Ducts and Fittings - Double Wall:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Wesco
      b. Wichita Sheet Metal
   2. Source Limitations: Obtain double-wall, round ducts and fittings from single manufacturer.
   3. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class indicated on the Drawings.
      a. Construct ducts of galvanized sheet steel.
      b. 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."
   4. Inner Duct: Minimum 24-gauge perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
   5. Interstitial Insulation, Fibrous Glass: Duct liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
      a. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
      b. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
      c. Coat insulation with antimicrobial coating.
      d. Cover insulation with polyester film complying with UL 181, Class 1.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
   1. Galvanized Coating Designation: G60.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.
   3. Lockforming Quality: Sheet steel and galvanized coating is to be able to be formed with back-to-back bends in seams such as the Pittsburgh lock at high speed without cracking or flaking of the coating on the outside of the bend.

C. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

D. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Aeroflex USA
      b. Armacell LLC
      c. K-Flex USA
   2. Source Limitations: Obtain flexible elastomeric duct liner from single manufacturer.
   3. 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.

4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. 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.
7. 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.
8. 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.
9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to 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. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. 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.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
1. Seal is to provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and is to be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. 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."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. 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.

G. Strut Support System for Ductwork - Metal, Cable Type:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. CADDY; brand of nVent Electrical plc
   b. Gripple Inc.
2. Source Limitations: Obtain metal cable type strut support system for ductwork from single manufacturer.
3. Description: Factory-fabricated ductwork support system consisting of cable clamps, slotted channel brackets, wire-rope suspension components, and associated accessories for a complete ductwork suspension system. No tools required for manual assembly in the field to support ductwork routing.
4. Components:
   a. Brackets: Slotted steel channels furnished in pre-cut lengths to suit specific system application for Project.
   b. Suspension Components: Hanging cables with adjustable fasteners.
      1) Wire Rope: High-tensile-steel wire rope, complying with ASTM A1023; lengths, diameters, and wire construction to accommodate design loads.
         a) Foot attachment type to suit application.
         b) End Fix Type: as required to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTS

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."

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 computer server rooms, 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.

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.

O. Installation of Metal, Cable-Type Strut Support System for Ductwork: Install in accordance with manufacturer's written installation instructions.

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."

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete expansion anchors, fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Do not use powder-actuated concrete fasteners.

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 ft..

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 DUCTWORK 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 other sections.

3.7 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.
   1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:
   1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
   2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   4. Coils and related components.
   5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
   6. Supply-air ducts, dampers, actuators, and turning vanes.
   7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:
   1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
   2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
   3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
   4. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
   5. Provide drainage and cleanup for wash-down procedures.

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 SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:.
      a. Pressure Class: Positive 1-inch wg.

C. Return Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:.
      a. Pressure Class: Positive or negative 1-inch wg.

D. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 1-inch wg.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive or negative 1-inch wg.

F. Intermediate Reinforcement:
   1. Galvanized-Steel Ducts: Galvanized steel.

G. Liner:
   1. ½" thick elastomeric duct liner shall be applied to all supply and return ducts within 10' of fan coil units. Where equipment uses supply and return plenums, plenums shall be lined and round branch runouts shall be unlined.

2. ½" thick elastomeric duct liner shall be applied to all supply and exhaust (intake) ducts within 10' of dedicated outside air units. Where equipment uses supply and return plenums, plenums shall be lined and round branch runouts shall be unlined.
3. ½" thick elastomeric duct liner shall be applied to all transfer ducts.

H. Elbow Configuration:
1. Rectangular Duct - Requirements for Different Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Velocity 1000 fpm (5 m/s) 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 (5 to 7.6 m/s):
      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 (7.6 m/s) 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 - Requirements for All Velocities: 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 (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm (7.6 m/s) 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:
      1) Stamped or pleated for 12 inches and smaller diameters.
      2) Standing seam for 14 inches and larger diameter.

I. 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 (5 m/s) or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
   c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Remote damper operators.
5. Flexible connectors.
6. Duct accessory hardware.
7. Flexible ducts, insulated.
8. Flexible duct connectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Construction details, material descriptions, and dimensions of individual components.
2. For dampers, include housings, linkages, and operators.
3. For damper operators, include electrical or pneumatic pressure rating and damper size rating.

B. Shop Drawings: For air duct accessories.
1. Plans showing locations, elevations, sections, and attachment details.
2. Duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
a. Special fittings.
b. Manual volume damper installations.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, or BIM model, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories.

PART 2 - PRODUCTS

2.1 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
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. Ruskin; Air Distribution Technologies, Inc.
b. Air Balance; MESTEK, Inc.
c. Aire Technologies, Inc.; DMI Companies
d. American Warming and Ventilating (AWV); Mestek, Inc.
e. Arrow United Industries; Mestek, Inc.
f. Cesco Products; MESTEK, Inc.
g. Greenheck Fan Corporation
h. Lloyd Industries, Inc.
i. McGill AirFlow LLC
j. Nailor Industries Inc
k. NCA Manufacturing, Inc.; Metal Industries, Inc.

l. Pottorff
m. Safe Air - Dowco
n. United Enertech Corp.
o. Vent Products Co., Inc

2. Performance:
   a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1 inch wg differential static pressure.
3. Construction:
   a. Linkage out of airstream.
   b. Suitable for horizontal or vertical airflow applications.
4. Frames:
   a. Hat-shaped, 16-gauge- thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized steel; 16 gauge thick.
6. Blade Axles: Nonferrous metal.
7. Bearings: Oil-impregnated bronze.
   a. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
8. Tie Bars and Brackets: Galvanized steel.
9. Locking device to hold damper blades in a fixed position without vibration.

B. Jackshaft:
1. Size: diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.2 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CL WARD & Family Inc.
2. Ductmate Industries, Inc; a DMI company
3. DynAir; a Carlisle Company
4. Elgen Manufacturing
5. Ward Industries; a brand of Hart & Cooley, LLC

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.3 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aero-Dyne Sound Control Co.
2. CL WARD & Family Inc.

3. Ductmate Industries, Inc; a DMI company
4. Duro Dyne Inc.
5. DynAir; a Carlisle Company
6. Elgen Manufacturing
7. Ward Industries; a brand of Hart & Cooley, LLC

B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Turning Vanes: Fabricate single -wall curved blades of galvanized steel.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

D. Vane Construction:
1. Wall: Single.

2.4 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. DynAir; a Carlisle Company
2. METALAIRE, Inc
3. United Enertech Corp.
4. Young Regulator Company

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.5 DUCT FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CL WARD & Family Inc.
2. Ductmate Industries, Inc; a DMI company
3. Duro Dyne Inc.
4. DynAir; a Carlisle Company
5. Elgen Manufacturing
6. Ventfabrics, Inc
7. Ward Industries; a brand of Hart & Cooley, LLC

B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials are to have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

C. Airstream Surfaces: Surfaces in contact with the airstream are to comply with requirements in ASHRAE 62.1.

D. Materials: Flame-retardant or noncombustible fabrics.

E. Coatings and Adhesives: Comply with UL 181, Class 1.

F. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

G. Indoor System, Duct 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.

2.6 DUCT ACCESSORY HARDWARE

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. CL WARD & Family Inc.
   2. Ductmate Industries, Inc; a DMI company
   3. Duro Dyne Inc.
   4. DynAir; a Carlisle Company
   5. Elgen Manufacturing
   6. Hardcast; Carlisle Construction Materials
   7. United Enertech Corp.
   8. Ventfabrics, Inc
   9. Ward Industries; a brand of Hart & Cooley, LLC

B. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.7 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
   1. Galvanized Coating Designation: G60.
   2. Exposed-Surface Finish: Mill phosphatized.

B. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

D. 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.

2.8 FLEXIBLE DUCTS, INSULATED

A. Standard: Product is to be UL 181 listed and bearing the UL label.

B. Flexible Ducts, Insulated - Class 1, Two-Ply Vinyl Film Supported by Helically Wound, Spring-Steel Wire; Fibrous-Glass Insulation:
   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. ATCO Rubber Products, Inc.
      b. Flexmaster U.S.A., Inc
      c. JP Lamborn Co.
   2. Pressure Rating: 10 inch wg positive and 1.0 inch wg negative.
   3. Maximum Air Velocity: 4000 fpm.
   4. Temperature Range: Minus 10 to plus 160 deg F.
   5. Insulation R-Value: R4.2.
   6. Vapor-Barrier Film: Polyethylene, ASTM E96/E96M.

C. Flexible Ducts, Insulated - Class 1, Black Polymer Film Supported by Helically Wound, Spring-Steel Wire; Fibrous-Glass Insulation:
   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. CASCO C.A. Schroeder, Inc.
      b. Flexmaster U.S.A., Inc
      c. JP Lamborn Co.
      d. Thermaflex; a Flex-Tek Group company

2. Pressure Rating: 4 inch wg positive and 0.5 inch wg negative.
3. Maximum Air Velocity: 4000 fpm.
4. Temperature Range: Minus 20 to plus 175 deg F.
5. Insulation R-Value: R4.2.
6. Vapor-Barrier Film: Polyethylene, ASTM E96/E96M.

2.9 FLEXIBLE DUCT CONNECTORS

A. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

B. Non-Clamp Connectors: Adhesive plus sheet metal screws.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR DUCT ACCESSORIES

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having a duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel. Dampers may not be indicated on drawings but shall be provided regardless, unless specifically noted to be omitted.
1. Install steel volume dampers in steel ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

F. Install flexible connectors to connect ducts to equipment.

G. Install duct test holes where required for testing and balancing purposes.

H. Install flexible ducts in accordance with applicable details in the following publications:
1. ADC's "Flexible Duct Performance & Installation Standards" for flexible ducts.
2. NAIMA AH116.
3. SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
4. SMACNA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

I. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

J. Connect flexible ducts to metal ducts with draw bands, adhesive plus sheet metal screws.

K. Installation of Flexible Ducts:
1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting must not exceed a minimum of one-duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.
6. Install in accordance with ADC instructions.
7. Do not install above inaccessible ceilings.
8. Do not install where exposed.

L. Supporting Flexible Ducts:

1. Support flexible duct at manufacturer's recommended intervals, but at no greater distance than 4 ft.. Provide sufficient support so that maximum centerline sag is 1/2 inch per ft. between supports. A connection to rigid duct or equipment may be considered a support joint.
2. Install extra supports at bends placed approximately one-duct diameter from center line of the bend.
3. Ducts may not rest on ceilings.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
   3. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233400 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ventilators, centrifugal - ceiling mounted.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. For each type of product.
      a. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
      b. Rated capacities, furnished specialties, and accessories for each fan.
      c. Fans:
         1) Certified fan performance curves with system operating conditions indicated.
         2) Certified fan sound-power ratings.
         3) Fan construction and accessories.
         4) Motor ratings and electrical characteristics, plus motor and electrical accessories.
         5) Fan speed controllers.
      d. Material thickness and finishes, including color charts.
      e. Dampers, including housings, linkages, and operators.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. Capacities and Characteristics: On Drawings.

2.2 VENTILATORS, CENTRIFUGAL - CEILING MOUNTED

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carnes Company
   2. Greenheck Fan Corporation
   3. Loren Cook Company
   4. PennBarry; division of Air System Components

B. Source Limitations: Obtain ceiling-mounted centrifugal ventilators from single manufacturer.

C. Standards: Comply with UL 705.

D. Housing: Steel, lined with acoustical insulation.

E. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel are removable for service.

F. Back-draft damper: Integral.

G. Grille: Plastic, louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.

H. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

I. Accessories:

1. Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."

B. Where variable-frequency drives are indicated or scheduled, provide fan motor compatible with variable-frequency drive.

2.4 SOURCE QUALITY CONTROL

A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.

B. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install fans level and plumb.

B. Equipment Mounting:
1. Support duct-mounted and other hanging fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install units with adequate clearances for service and maintenance.

3.2 DUCTWORK CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Where installing ducts adjacent to fans, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
1. Nameplate is to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 ADJUSTING

A. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.6 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

END OF SECTION 233400

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SECTION 233713.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ceiling diffusers

B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for volume-control dampers not integral to diffusers.
   2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. For each type of product.
      a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
      b. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carnes Company
   2. Krueger-HVAC
   3. Nailor Industries
   4. Price Industries
   5. Titus

B. Source Limitations: Obtain from single source from single manufacturer.

C. Finish: Baked enamel, white unless indicated otherwise.

D. Mounting: Ceiling, surface, or direct. Provide accessories and frame styles required for installation at each location.

E. See schedule on drawings.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers in accordance with ASHRAE 70.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR DIFFUSERS

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233713.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Registers
   2. Grilles

B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for volume-control dampers not integral to registers and grilles.
   2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. For each type of product.
      a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
      b. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carnes Company
   2. Krueger-HVAC
   3. Nailor Industries
   4. Price Industries
   5. Titus

B. Source Limitations: Obtain from single source from single manufacturer.

C. Finish: Baked enamel, white unless indicated otherwise.

D. Mounting: Ceiling, surface, or direct. Provide accessories and frame styles required for installation at each location.

E. See schedule on drawings.

2.2 GRILLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carnes Company
   2. Krueger-HVAC
   3. Nailor Industries
   4. Price Industries
   5. Titus

B. Source Limitations: Obtain from single source from single manufacturer.

C. Finish: Baked enamel, white unless indicated otherwise.

D. Mounting: Ceiling, surface, or direct. Provide accessories and frame styles required for installation at each location.

E. See schedule on drawings.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles in accordance with ASHRAE 70.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are 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 OF REGISTERS AND GRILLES

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers and air extractors.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 233813 - COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Packaged Kitchen Exhaust Hood Systems.

1.2 DEFINITIONS

A. Listed Hood System: A hood system ETL tested and compliant with UL300A.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Hood Systems

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PACKAGED KITCHEN EXHAUST HOOD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Denlar
   2. Accurex

B. Standards of construction:
   1. Hood shall be constructed of 18 gauge minimum, 300 Series stainless steel outer shell.
   2. Hood shall be provided in width required to cover range. Coordinate with G.C. prior to ordering.
   3. Hood shall be manufactured and assembled with no visible outer welds or weld marks.
   4. All internal seams shall be sealed with NSF-approved caulk.
   5. A metal baffle filter shall be provided.
   6. One LED hood light shall provide lighting on the range below.
   7. The hood shall integrate with the cooking equipment to deactivate the cooking equipment in the event of a fire suppression discharge or a system fault.
   8. Kitchen ventilation Hood shall be recirculating or exhaust only and cover a domestic range in commercial environments used for light duty cooking purposes only.
   9. The Hood shall be ICC evaluated and certified as compliant with International Mechanical Code (IMC), International Fire Code (IFC), and Uniform Mechanical Code (UMC).
   10. If provided with a fan, the fan shall be UL 507 listed or equivalent.
   11. The Fire Suppression Hood shall be listed by ETL to the standards of the UL Subject 300A. Hood shall be configured as wall style (supplied with wall mounting bracket).
   12. Hood shall include factory-installed UL Subject 300A fire suppression system, including environmental monitoring, wire rope, fail-safe fusible links and mechanical actuation. No electronic detection or actuation shall be accepted.
   13. Fire suppression shall be a fail-safe, mechanical, method and consist of three fusible links (212º for 30”, 280º for 36”), temperature switches that monitor the cooking surface and upon reaching the first set-point, send a signal to turn the fan ON, at the second set point sends a signal to maintain the fan ON, while also sending a signal to shut OFF power to the range and sounding a local alarm. When the set point of the fusible links is reached, the tension on the actuator paddle releases pushing down on the actuator of the suppression tank; expelling the wet chemical agent from the pre-charged tank, a signal is sent to shut OFF power to the range and a local and building fire alarm (when connected) will be activated.

14. Tank pressure shall be monitored using tank pressure switch and a fault will cause the system alarm to sound and the LED status light will simultaneously flash four times. Pressure gauge indicating the tank pressure will be visible on the front of the hood. Mirrors to access the gauge shall not be acceptable.
15. All fire suppression and control components must be easily accessible by dropping the
16. Hood into a service position to allow for service without removing the Hood from the wall. Thumb screws shall be utilized to hold the Hood into place for normal operation. No latches are acceptable.
17. Hood system shall be provided with a gas (3/4 inch), electric, or dual fuel disconnect supplied with plug and play cable that will shut down the power to the stove in the event of a system monitored condition occurring.
18. Hood must include: a minimum of 500 CFM fan, interlocked (password protected) appliance disconnect with timed-automatic range deactivation and manual pull station.
19. Pull station shall be a mechanical pull station. Electronic pull station is not acceptable.
20. User controls shall be provided to control fan and lights. A Hood mounted touchscreen is not acceptable. The Hood or System status LED and audible alarm may be used to determine any faults within the system. All Hood controls must be accessed by switches and potentiometers on the Hood itself unless supplied with an ADA Switch with factory provided plug and play cable or controlled in conjunction with a touchscreen that is mounted remotely.
21. The Hood system shall be equipped with either a factory-supplied integral fan, factory-supplied external fan, or fan by others with manufacturer provided relay. Integral fan options include either front recirculating or rear discharge.
22. Front recirculating style shall include an easily accessible charcoal filter and opening in the front of the Hood for filtering the exhaust air before discharging back into the space. Rear discharge style shall direct the air to exit the back of the hood, to discharge through a wall to the outside.
23. External fan options include either a factory-provided inline fan (with plug and play cable), wall mount fan, roof fan or fan by others option with a top discharge Hood configuration. Top discharge style shall direct the air to exit the top of the hood, to discharge through a roof or wall to the outside. All factory provided fan options shall be listed to UL 507 standards.
24. Fire alarm dry contacts shall be provided.
25. Check, Test and Balance: The kitchen exhaust system shall be inspected, tested and balanced by a qualified contractor. The contractor shall ensure proper and satisfactory operation of the kitchen exhaust system and shall provide a written and detailed report of this check, test and startup to the Engineer and Owner.
26. Warranty: Hood shall have a three-year product only warranty. Warranty does not include labor.
27.

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. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Coordinate equipment layout and installation with adjacent Work, including luminaires, HVAC equipment, plumbing, and fire-suppression system components.

B. Install all equipment in strict accordance with manufacturer’s instructions.

C. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners unless otherwise indicated.

E. Install hoods to operate free from vibration.

F. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

G. Set field-adjustable switches.

3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial-kitchen hoods.

END OF SECTION 233813

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SECTION 235416.13 - GAS-FIRED FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gas-fired furnaces, condensing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:
   1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals.
   1. Include the following:
      a. Furnace and accessories complete with controls.
      b. Air filter.
      c. Refrigeration components.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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. Disposable Air Filters: Furnish two complete sets.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:
   1. Warranty Period, Commencing on Date of Substantial Completion:
      a. Furnace Heat Exchanger: 10 years.
      b. Integrated Ignition and Blower Control Circuit Board: Five years.
      c. Draft-Inducer Motor: Five years.
      d. Evaporator and Condenser Coils: Five years.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency, and marked for intended location and application.

2.2 GAS-FIRED FURNACES, CONDENSING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Comfortmaker; Carrier Global Corporation

2. Lennox
3. Trane
4. YORK; brand of Johnson Controls International plc, Building Solutions North America

B. Cabinet: Steel.
1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
1. Fan Motors: Comply with requirements in Section 230500 "Common Work Results for HVAC."
2. Special Motor Features, ECM: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

D. Type of Gas: Natural.

E. Heat Exchanger:
1. Primary: Aluminized steel.

F. Burner:
1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

G. Gas-Burner Safety Controls:
1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

H. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

I. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.

J. Accessories:
1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall or [roof.
2. PVC Plastic Vent Materials:
a. PVC Plastic Pipe: Schedule 40, complying with ASTM D1785.
b. PVC Plastic Fittings: Schedule 40, complying with ASTM D2466, socket type.
c. PVC Solvent Cement: ASTM D2564.

K. Capacities and Characteristics: On Drawings

2.3 THERMOSTATS AND HUMIDISTATS

A. Two-Stage, Heating-Cooling Thermostat: Adjustable, heating-cooling, wall-mounted unit with fan on-automatic selector.

2.4 AIR FILTERS

A. Disposable Filters: 1-inch- thick fiberglass media with ASHRAE 52.2 MERV rating of 8 or higher, in sheet metal frame.

2.5 REFRIGERATION COMPONENTS

A. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with AHRI 210/240. Match size with furnace. Include condensate drain pan with accessible drain outlet.
   1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

B. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

C. Refrigerant Piping: Comply with requirements in Section 232300 "Refrigerant Piping."

D. Air-Cooled Compressor-Condenser Unit:
   1. Comply with requirements in Section 236200 “Packaged Compressor and Condenser Units.”

E. Capacities and Characteristics: On Drawings.

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 factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

D. Controls: Install thermostats and humidistats at mounting height of 48 inches above floor.

E. Wiring Method:
   1. Where exposed or concealed within walls or above inaccessible ceilings, install control wiring in conduit in accordance with section 260533.13 “Conduits For Electrical Systems.” Provide device box in accordance with section 260533.16 “Boxes and Covers For Electrical Systems.”
   2. Where concealed above accessible ceiling spaces cable may be installed without conduit. Cable shall be run parallel and perpendicular to building surfaces and supported independently from structure. Do not tie cable off to conduit, piping, duct, etc.

3.3 PIPING CONNECTIONS

A. Gas piping installation requirements are specified in Section 231123 "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
      a. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
      b. CPVC Piping: Join according to ASTM D2846/D2846M, Appendix.
      c. PVC Pressure Piping: Join schedule number ASTM D1785 PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
   4. Slope pipe vent back to furnace or to outside terminal.

D. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled compressor-condenser unit.
   1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
   2. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.
   3. 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/A5.8M.

E. Comply with requirements in Section 232300 "Refrigerant Piping" for installation and joint construction of refrigerant piping.

3.4 DUCTWORK CONNECTIONS

A. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233300 "Air Duct Accessories."

3.5 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 electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.7 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
   1. Inspect for physical damage to unit casings.
   2. Verify that access doors move freely and are weathertight.
   3. Clean units and inspect for construction debris.
   4. Verify that all bolts and screws are tight.
   5. Adjust vibration isolation and flexible connections.
   6. Verify that controls are connected and operational.

B. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.

C. Measure and record airflows.

D. Verify proper operation of capacity control device.

E. After startup and performance test, lubricate bearings.

3.8 ADJUSTING

A. Adjust initial temperature set points as directed by Owner. Program thermostat operating schedules as directed by Owner.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.9 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace within 14 days after Substantial Completion.

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Perform electrical test and visual and mechanical inspection.
   2. Leak Test: After installation, charge systems with refrigerant and test for leaks. Repair leaks, replace lost refrigerant, and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
   4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
   5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain furnaces and thermostats.

END OF SECTION 235416.13

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SECTION 236200 - PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Compressor and condenser units, air cooled, 1 to 5 tons (3.5 to 17.6 kW).

1.2 ACTION SUBMITTALS

A. Product Data: For each compressor and condenser unit.
   1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
   2. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.

B. Shop Drawings: For compressor and condenser units.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Startup service reports.

B. Field quality-control reports.

C. Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressor and condenser units to include in emergency, operation, and maintenance manuals.

1.5 COORDINATION

A. Coordinate location of piping and electrical rough-ins.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Compressor failure.
      b. Condenser coil leak.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fabricate and label refrigeration system in accordance with ASHRAE 15 and ASHRAE 34.

B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

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.

2.2 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 1 TO 5 TONS (3.5 TO 17.6 kW)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Trane
   2. YORK; brand of Johnson Controls International plc, Building Solutions North America

B. Compressor and Condenser units shall be of same manufacturer as gas furnace or blower coil unit.

C. Description: Factory assembled and tested; consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.

D. Compressor Type: Scroll, hermetically sealed, with rubber vibration isolators.
   1. Motor: includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   2. Accumulator: Suction tube.

E. Refrigerant: R-454B.

F. Condenser Coil: Seamless copper-tube, aluminum -fin coil; with removable drain pan and brass service valves with service ports.

G. Condenser Fan: Direct-drive, metal propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection.

H. Accessories:
   1. Crankcase heater.
   2. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
   3. Filter-dryer.
   4. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
   5. Liquid-line solenoid.
   6. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
   7. Precharged and preinsulated suction and liquid tubing.
   8. Thermostatic expansion valve for installation at evaporator coil.
   9. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.

I. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gauge ports on exterior of casing.

J. Capacities and Characteristics: On Drawings.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 SOURCE QUALITY CONTROL

A. Performance Ratings: Certify capacity performance ratings of compressor and condenser units in accordance with AHRI 210/240.

B. Sound-Power Level Ratings: Factory test sound-power-level ratings in accordance with AHRI 270.

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 compressor and condenser units.

B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where compressor and condenser units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated.

B. Equipment Mounting:
   1. Install compressor and condenser units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 03300 "Cast-In-Place Concrete."

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install piping specialties, electrical components, devices, and accessories that are not factory mounted.

3.3 PIPING CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance.

B. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.

C. Connect refrigerant piping to air-cooled compressor and condenser units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Section 232300 "Refrigerant Piping."

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate is to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.
   1. Route exposed control cable in conduit in accordance with Section 260533.13 “Conduits For Electrical Systems.”

3.6 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks in accordance with manufacturer's written instructions and perform the following:
      a. Inspect for physical damage to unit casing.
      b. Verify that access doors move freely and are weathertight.
      c. Clean units and inspect for construction debris.
      d. Verify that all bolts and screws are tight.
      e. Adjust vibration isolation and flexible connections.
      f. Verify that controls are connected and operational.

B. Start unit in accordance with manufacturer's written instructions and complete manufacturer's startup checklist.

C. Measure and record airflow and air temperature rise over coils.

D. Verify operation of condenser capacity control device.

E. Verify that vibration isolation and flexible connections prevent vibration transmission to structure.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections :
   1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
   2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   5. Verify manufacturer's required airflow over coils.

B. Verify that vibration isolation and flexible connections prevent vibration transmission to structure.

C. Compressor and condenser units will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain compressor and condenser units.

END OF SECTION 236200

SECTION 260010 - SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements generally applicable to all electrical Work on the Project, including but not limited to Work specified in Divisions 26, 27, and 28.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:
1. 8P8C: An 8-position 8-contact modular jack.
2. A: Ampere, unit of electrical current.
3. AC or ac: Alternating current.
4. AFCI: Arc-fault circuit interrupter.
5. AGC: Automatic gain control.
6. AIC: Ampere interrupting capacity.
7. AL, Al, or ALUM: Aluminum.
8. ASD: Adjustable-speed drive.
9. ATP: Acceptance test procedure.
10. ATS: Automatic transfer switch.
11. A/V: Audio/visual.
12. AWG: American wire gauge; see ASTM B258.
13. BAS: Building automation system.
14. BDA: Bi-directional amplifier.
15. BIL: Basic impulse insulation level.
16. BIM: Building information modeling.
17. BMS: Building management system.
18. BNC: Bayonet Neill-Concelman - type of connector.
19. B/W: Black and white.
20. CAD: Computer-aided design or drafting.
21. CATV: Community antenna television.
22. CB: Circuit breaker.
23. CCD: Charge-coupled device.
24. CCTV: Closed-circuit television.
25. cd: Candela, the SI fundamental unit of luminous intensity.
26. CO/ALR: Copper-aluminum, revised.
27. COPS: Critical operations power system.
28. CU or Cu: Copper.
29. CU-AL or AL-CU: Copper-aluminum.
30. DACR: Digital alarm communicator receiver.
31. DACT: Digital alarm communicator transmitter.
32. DAS: Distributed antenna system.
33. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
34. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
35. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
36. dBm: Decibel absolute power with respect to 1 mW.
37. dBmV: Decibel absolute voltage with respect to 1 mV across identical impedance.
38. DC or dc: Direct current.
39. DCOA: Designated critical operations area.
40. DDC: Direct digital control (HVAC).
41. DGP: Data gathering panel.
42. DHCP: Dynamic host configuration protocol.
43. EGC: Equipment grounding conductor.

44. ELV: Extra-low voltage.
45. EMF: Electromotive force.
46. EMI: Electromagnetic interference.
47. EMP: Electrical maintenance program (operation and maintenance); electromagnetic pulse (transient analysis).
48. EPS: Emergency power supply.
49. EPSS: Emergency power supply system.
50. ERCES: Emergency responder communications enhancement system.
51. ESS: Energy storage system.
52. EV: Electric vehicle.
53. EVPE: Electric vehicle power export equipment.
54. EVSE: Electric vehicle supply equipment.
55. FACU: Fire-alarm control unit.
56. FAS: Fire-alarm system.
57. fc: Footcandle, an internationally recognized unit of illuminance equal to one lumen per square foot or 10.76 lx. The simplified conversion 1 fc = 10 lx in the Specifications is common practice and considered adequate precision for building construction activities. When there are conflicts, lux is the primary unit; footcandle is specified for convenience.
58. FCC: Federal Communications Commission; fire command center.
59. FLC: Full-load current.
60. ft: Foot.
61. ft-cd: Foot-candle, the antiquated U.S. standard unit of illuminance, equal to one international candle measured at a distance of one foot, that was superseded in 1948 by the unit "footcandle" when the SI unit candela (cd) replaced the international candle; see "fc."
62. FTP: File transfer protocol.
63. FXO: Foreign exchange office.
64. GEC: Grounding electrode conductor.
65. GFCI: Ground-fault circuit interrupter.
66. GFPE: Ground-fault protection of equipment.
67. GND: Ground.
68. GROL: General Radiotelephone Operator License (FCC).
69. H.323: Audio and video protocol.
70. HACR: Heating, air conditioning, and refrigeration.
71. HDPE: High-density polyethylene.
72. HID: High-intensity discharge.
73. HP or hp: Horsepower.
74. HVAC: Heating, ventilating, and air conditioning.
75. Hz: Hertz.
76. I&TFAS: Inspection and testing of fire-alarm system.
77. IB-PSC: In-building public safety communications.
78. IBT: Intersystem bonding termination.
79. ICT: Information and communications technology.
80. IDC: Initiating device circuit.
81. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
82. I/O: Input/output.
83. IP: Ingress protection rating (enclosures); Internet protocol (communications).
84. IR: Infrared.
85. IS: Intrinsically safe.
86. IT&R: Inspecting, testing, and repair.
87. ITE: Information technology equipment.
88. kAIC: Kiloampere interrupting capacity.
89. kcmil or MCM: One thousand circular mils.
90. kV: Kilovolt.
91. kVA: Kilovolt-ampere.
92. kvar: Kilovolt-ampere reactive.
93. kW: Kilowatt.

94. kWh: Kilowatt-hour.
95. LAN: Local area network.
96. lb: Pound (weight).
97. lbf: Pound (force).
98. LCD: Liquid-crystal display.
99. LCDI: Leakage-current detector-interrupter.
100. LED: Light-emitting diode.
101. Li-ion: Lithium-ion.
102. lm: Lumen, the SI-derived unit of luminous flux.
103. LNG: Liquefied natural gas.
104. LP-Gas: Liquefied petroleum gas.
105. LRC: Locked-rotor current.
106. LTE: Long-term evolution (mobile device technology standard).
107. LV: Low voltage.
108. lx: Lux, the SI-derived unit of illuminance equal to one lumen per square meter.
109. m: Meter.
110. MATV: Master antenna television.
111. MCC: Motor-control center.
112. MDC: Modular data center.
113. MG set: Motor-generator set.
114. MIDI: Musical instrument digital interface.
115. MLO: Main lugs only.
116. MPEG: Moving Picture Experts Group.
117. MPEG-2: Abbreviation for the ISO/IEC Moving Picture Experts Group's standard for generic coding of moving pictures and associated audio information (ISO/IEC 13818) released in 1995 and used for most over-the-air and satellite broadcast digital television.
118. MPEG-4: Abbreviation for the ISO/IEC Moving Picture Experts Group's standard framework for coding of audio-visual objects (ISO/IEC 14496) released in 1999, with digital rights management and more advanced compression algorithms than MPEG-2.
119. MOV: Metal-oxide varistor.
120. MV: Medium voltage.
121. MVA: Megavolt-ampere.
122. mW: Milliwatt.
123. MW: Megawatt.
124. MWh: Megawatt-hour.
125. NAC: Notification appliance circuit.
126. N.C.: Normally closed.
127. NFC: Near field communications.
128. Ni-Cd: Nickel-cadmium.
129. NICET: National Institute for Certification in Engineering Technologies, a division of the National Society of Professional Engineers.
130. Ni-MH: Nickel-metal hydride.
131. NIU: Network interface unit.
132. N.O.: Normally open.
133. NPT: National (American) standard pipe taper.
134. NTSC: National Television System Committee.
135. OCPD: Overcurrent protective device.
136. ONT: Optical network terminal.
137. PC: Personal computer.
138. PCS: Power conversion system.
139. PCU: Power-conditioning unit.
140. Percent obs/ft (percent obs/m): Percent obscuration per unit distance; unit of measure for sensitivity of smoke detectors.
141. PF or pf: Power factor.
142. PHEV: Plug-in hybrid electric vehicle.
143. PIR: Passive infrared.

144. PLC: Programmable logic controller.
145. PLFA: Power-limited fire alarm.
146. PoE: Power over Ethernet.
147. POTS: Plain old telephone service. See "public switched telephone network" definition.
148. PSTN: Public switched telephone network.
149. PTZ: Pan-tilt-zoom.
150. PV: Photovoltaic.
151. PVC: Polyvinyl chloride.
152. pW: Picowatt.
153. RAID: Redundant array of inexpensive disks; redundant array of independent disks.
154. RAM: Random-access memory.
155. RAT: Radio alarm transmitter.
156. REX: Request-to-exit.
157. RF: Radio frequency.
158. RFI: (electrical) Radio-frequency interference; (contract) Request for interpretation.
159. RMS or rms: Root-mean-square.
160. RPM or rpm: Revolutions per minute.
161. SCADA: Supervisory control and data acquisition.
162. SCCR: Short-circuit current rating.
163. SCR: Silicon-controlled rectifier.
164. SIP: Session initiation protocol.
165. SLC: Signaling-line circuit.
166. SPD: Surge protective device.
167. SPDT: Single pole, double throw.
168. sq.: Square.
169. SWD: Switching duty.
170. TCP/IP: Transmission Control Protocol/Internet Protocol.
171. TEFC: Totally enclosed fan-cooled.
172. TR: Tamper resistant.
173. TVSS: Transient voltage surge suppressor.
174. UHF: Ultra-high frequency.
175. UL: (standards) UL Standards & Engagement Inc.; (product categories) UL, LLC.
176. UL CCN: UL Category Control Number.
177. UPS: Uninterruptible power supply.
178. USB: Universal serial bus.
179. UTC: Coordinated universal time.
180. UV: Ultraviolet.
181. V: Volt, unit of electromotive force.
182. V(ac): Volt, alternating current.
183. V(dc): Volt, direct current.
184. VA: Volt-ampere, unit of complex electrical power.
185. VAR: Volt-ampere reactive, unit of reactive electrical power.
186. VFC: Variable-frequency controller.
187. VOM: Volt-ohm-multimeter.
188. VoIP: Voice over Internet Protocol.
189. VPN: Virtual private network.
190. VRLA: Valve regulated lead acid; also called "sealed lead acid (SLA)" or "valve regulated sealed lead acid."
191. VU: Volume unit.
192. W: Watt, unit of real electrical power.
193. WAN: Wide area network.
194. Wh: Watt-hour, unit of electrical energy usage.
195. WPT: Wireless power transfer.
196. WPTE: Wireless power transfer equipment.
197. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:
   1. EMT: Electrical metallic tubing.
   2. EMT-A: Aluminum electrical metallic tubing.
   3. EMT-S: Steel electrical metallic tubing.
   4. EMT-SS: Stainless steel electrical metallic tubing.
   5. ENT: Electrical nonmetallic tubing.
   6. EPEC: Electrical HDPE underground conduit (thin wall).
   7. EPEC-A: Type A electrical HDPE underground conduit.
   8. EPEC-B: Type B electrical HDPE underground conduit.
   9. ERMC: Electrical rigid metal conduit.
   10. ERMC-A: Aluminum electrical rigid metal conduit.
   11. ERMC-S: Steel electrical rigid metal conduit.
   12. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
   13. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
   14. ERMC-SS: Stainless steel electrical rigid metal conduit.
   15. FMC: Flexible metal conduit.
   16. FMC-A: Aluminum flexible metal conduit.
   17. FMC-S: Steel flexible metal conduit.
   18. FMT: Steel flexible metallic tubing.
   19. FNMC: Flexible nonmetallic conduit. See "LFNC."
   20. HDPE: HDPE underground conduit (thick wall).
   21. HDPE-40: Schedule 40 HDPE underground conduit.
   22. HDPE-80: Schedule 80 HDPE underground conduit.
   23. IMC: Steel electrical intermediate metal conduit.
   24. LFMC: Liquidtight flexible metal conduit.
   25. LFMC-A: Aluminum liquidtight flexible metal conduit.
   26. LFMC-S: Steel liquidtight flexible metal conduit.
   27. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
   28. LFNC: Liquidtight flexible nonmetallic conduit.
   29. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
   30. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
   31. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
   32. PVC: Rigid PVC conduit.
   33. PVC-40: Schedule 40 rigid PVC conduit.
   34. PVC-80: Schedule 80 rigid PVC Conduit.
   35. PVC-A: Type A rigid PVC concrete-encased conduit.
   36. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
   37. RGS: See ERMC-S-G.
   38. RMC: See ERMC.
   39. RTRC: Reinforced thermosetting resin conduit.
   40. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
   41. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
   42. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
   43. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
   44. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.

C. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:
   1. AC: Armored cable.
   2. CATV: Coaxial general-purpose cable.
   3. CATVP: Coaxial plenum cable.
   4. CATVR: Coaxial riser cable.
   5. CI: Circuit integrity cable.
   6. CL2: Class 2 cable.
   7. CL2P: Class 2 plenum cable.
   8. CL2R: Class 2 riser cable.

9. CL2X: Class 2 cable, limited use.
10. CL3: Class 3 cable.
11. CL3P: Class 3 plenum cable.
12. CL3R: Class 3 riser cable.
13. CL3X: Class 3 cable, limited use.
14. CM: Communications general-purpose cable.
15. CMG: Communications general-purpose cable.
16. CMP: Communications plenum cable.
17. CMR: Communications riser cable.
18. CMUC: Under-carpet communications wire and cable.
19. CMX: Communications cable, limited use.
20. DG: Distributed generation cable.
21. FC: Flat cable.
22. FCC: Flat conductor cable.
23. FPL: Power-limited fire-alarm cable.
24. FPLP: Power-limited fire-alarm plenum cable.
25. FPLR: Power-limited fire-alarm riser cable.
26. IGS: Integrated gas spacer cable.
27. ITC: Instrumentation tray cable.
28. ITC-ER: Instrumentation tray cable, exposed run.
29. MC: Metal-clad cable.
30. MC-FPL/FPLR/FPLP: Metal-clad cable containing FPL, FPLR, or FPLP.
31. MC-HL: Metal-clad cable, hazardous location.
32. MI: Mineral-insulated, metal-sheathed cable.
33. MTW: (machine tool wiring) Moisture-, heat-, and oil-resistant thermoplastic cable.
34. MV: Medium-voltage cable.
35. NM: Nonmetallic sheathed cable.
36. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
37. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
38. NPLF: Non-power-limited fire-alarm circuit cable.
39. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
40. NPLFR: Non-power-limited fire-alarm circuit riser cable.
41. NUCC: Nonmetallic underground HDPE conduit with conductors.
42. OFC: Conductive optical fiber general-purpose cable.
43. OFCG: Conductive optical fiber general-purpose cable.
44. OFCP: Conductive optical fiber plenum cable.
45. OFCR: Conductive optical fiber riser cable.
46. OFN: Nonconductive optical fiber general-purpose cable.
47. OFNG: Nonconductive optical fiber general-purpose cable.
48. OFNP: Nonconductive optical fiber plenum cable.
49. OFNR: Nonconductive optical fiber riser cable.
50. P: Marine shipboard cable.
51. PLTC: Power-limited tray cable.
52. PLTC-ER: Power-limited tray cable, exposed run.
53. PV: Photovoltaic cable.
54. RHH: (high heat) Thermoset rubber, heat-resistant cable.
55. RHW: Thermoset rubber, moisture-resistant cable.
56. SA: Silicone rubber cable.
57. SE: Service-entrance cable.
58. SER: Service-entrance cable, round.
59. SEU: Service-entrance cable, flat.
60. SIS: Thermoset cable for switchboard and switchgear wiring.
61. TBS: Thermoplastic cable with outer braid.
62. TC: Tray cable.
63. TC-ER: Tray cable, exposed run.

64. TC-ER-HL: Tray cable, exposed run, hazardous location.
65. THW: Thermoplastic, heat- and moisture-resistant cable.
66. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
67. THHW: Thermoplastic, heat- and moisture-resistant cable.
68. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
69. TW: Thermoplastic, moisture-resistant cable.
70. UF: Underground feeder and branch-circuit cable.
71. USE: Underground service-entrance cable.
72. XHH: Cross-linked polyethylene, heat-resistant cable.
73. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

D. Abbreviations and Acronyms for Electrical Flexible Cord Types:
1. SEO: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
2. SEOW: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
3. SEOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
4. SEOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
5. SJEO: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
6. SJEOW: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
7. SJEOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
8. SJEOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
9. SJO: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp locations.
10. SJOW: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
11. SJOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp locations.
12. SJOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
13. SJTO: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
14. SJTOW: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
15. SJTOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
16. SJTOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
17. SO: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp locations.
18. SOW: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
19. SOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp locations.
20. SOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
21. STO: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
22. STOW: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.

23. STOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
24. STOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.

E. Abbreviations for Grounding and Bonding:
1. BBC: Backbone bonding conductor, for connecting multiple TBBs serving the same floor.
2. PBB: Primary bonding busbar; located in main distribution frame room, ideally near electrical service entrance.
3. RBB: Rack bonding busbar; located in equipment cabinets and racks.
4. SBB: Secondary bonding busbar; located in intermediate distribution frame rooms.
5. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.
6. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.
7. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.
8. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

F. Definitions:
1. Cable: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "cable" is (1) a conductor with insulation, or a stranded conductor with or without insulation (single-conductor cable); or (2) a combination of conductors insulated from one another (multiple-conductor cable).
2. Conductive Cable: Cable containing non-current-carrying electrically conductive members such as metallic strength members and metallic vapor barriers.
3. Conductor: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "conductor" is (1) a wire or combination of wires not insulated from one another, suitable for carrying an electric current; (2) (National Electrical Safety Code) a material, usually in the form of wire, cable, or bar, suitable for carrying an electric current; or (3) (general) a substance or body that allows a current of electricity to pass continuously along it.
4. Conduit: A structure containing one or more duct raceways.
5. Direct Buried: Installed underground without encasement in concrete or other protective material.
6. Electrical Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
7. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that is designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety of human life.
8. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
    a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
    b. Concrete Box: A box intended for use in poured concrete.
    c. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
    d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
    e. Cover Plate: A cover designed for protecting wiring devices installed in flush-mounted device boxes while permitting their safe operation; also called a faceplate or wallplate.
    f. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
    g. Device Box: A box with provisions for mounting a wiring device directly to the box.
    h. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.

i. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
j. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
k. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
l. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
m. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
n. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
o. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
p. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.

9. Jacket: A continuous nonmetallic outer covering for conductors or cables.
10. Local Operator Console (LOC): Equipment used by authorized personnel and emergency responders to activate and operate a mass notification system (MNS).
11. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
12. Monitoring: Acquisition, processing, communication, and display of system and equipment status data and event and alarm signals.
13. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
14. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
15. Nonsecure: Unlocked or open. (For doors and gates.)
16. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein. Also called "single-line diagram."
17. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
18. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
19. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.
20. Protective Device: A device that senses when an abnormal current flow, abnormal voltage potential, or other abnormal electrical waveform exists and then disconnects the affected portion of the circuit from the system. Common protective devices include fuses, circuit breakers, relays, ground-fault circuit interrupters, and arc-fault circuit interrupters.
21. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
22. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
23. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
24. Secure: Closed and locked and with no unlock or open commands pending. (For doors and gates.)
25. Sheath: A continuous metallic covering for conductors or cables.
26. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
27. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
28. UL Category Control Number (CCN): An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.

29. Voice over Internet Protocol (VoIP): Digital telephone packet technology that uses the internet for its transmission medium.
30. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
    a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
    b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
    c. Extra-Low Voltage (ELV): Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
    d. Low Voltage (LV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
    e. Medium Voltage (MV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.
    f. High Voltage: (1) (circuits) Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 69 kV but not exceeding 230 kV. (2) (safety) Having sufficient electromotive force to inflict bodily harm or injury.
31. Wire: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "wire" is a slender rod or filament of drawn metal. A group of small wires used as a single wire is properly called a "stranded wire." A wire or stranded wire covered with insulation is properly called an "insulated wire" or a "single-conductor cable." Nevertheless, when the context indicates that the wire is insulated, the term "wire" will be understood to include the insulation.

1.3 SEQUENCING

A. Conduct and submit results of power system studies before submitting product data and Shop Drawings for electrical equipment.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of electrical Work on the Project. Consult Architect for resolution of conflicting requirements.

END OF SECTION 260010

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoplastic-insulated wire.
   2. Metallic sheathed cable.
   3. Connectors and splices.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
   2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
   3. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers, supports, and concrete bases referenced by this Section.
   4. Section 260533.13 "Conduits for Electrical Systems" specifies installation of raceways referenced by this Section.
   5. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" specifies installation of sleeves and sleeve seals referenced by this Section.
   6. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.

1.2 ACTION SUBMITTALS

A. Product Schedule: Indicate type, use, location, and termination locations.

B. Product Data: For each type of product.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 THERMOPLASTIC-INSULATED WIRE

A. Description: Thermoplastic-insulated wire for use in accordance with Article 310 of NFPA 70.

B. UL ZLGR - Type THHN Insulated Wire:
   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. Cerro Wire LLC
      b. Southwire Company, LLC
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Thermoplastic-Insulated Wire: UL CCN ZLGR, including UL 83.
   3. Standard Features:
      a. Referenced Standard: Article 310 of NFPA 70.
      b. Insulation Voltage Rating: 600 V.
      c. Insulation Temperature Rating: 90 deg C.
      d. Conductor Material: Copper.
      e. Conductor Size: As indicated on the Drawings.

1) Minimum Conductor Size: 12 AWG.

C. UL ZLGR - Type THHW Insulated Wire:
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. Alpha Wire; brand of Belden, Inc.
b. Southwire Company, LLC
c. Cerro Wire LLC
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. Thermoplastic-Insulated Wire: UL CCN ZLGR, including UL 83.
3. Standard Features:
a. Referenced Standard: Article 310 of NFPA 70.
b. Insulation Voltage Rating: 600 V.
c. Insulation Temperature Rating: 90 deg C.
d. Conductor Material: Copper.
e. Conductor Size: As indicated on the Drawings.
1) Minimum Conductor Size: 12 AWG.

D. UL ZLGR - Type THWN Insulated Wire:
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. Alpha Wire; brand of Belden, Inc.
b. Cerro Wire LLC
c. Southwire Company, LLC
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. Thermoplastic-Insulated Wire: UL CCN ZLGR, including UL 83.
3. Standard Features:
a. Referenced Standard: Article 310 of NFPA 70.
b. Insulation Voltage Rating: 600 V.
c. Insulation Temperature Rating: 75 deg C.
d. Conductor Material: Copper.
e. Conductor Size: As indicated on the Drawings.
1) Minimum Conductor Size: 12 AWG.

E. UL ZLGR - Type THWN-2 Insulated Wire:
1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
a. Alpha Wire; brand of Belden, Inc.
b. Cerro Wire LLC
c. Southwire Company, LLC
d. <**Insert manufacturer's name**>
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. Thermoplastic-Insulated Wire: UL CCN ZLGR, including UL 83.
3. Standard Features:
a. Referenced Standard: Article 310 of NFPA 70.
b. Insulation Voltage Rating: 600 V.
c. Insulation Temperature Rating: 90 deg C.
d. Conductor Material: Copper.
e. Conductor Size: As indicated on the Drawings.

1) Minimum Conductor Size: 12 AWG.

2.3 METALLIC SHEATHED CABLE

A. UL PJAZ - Metal-Clad Cable, Type MC:
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. Alpha Wire; brand of Belden, Inc.
   b. Cerro Wire LLC
   c. Southwire Company, LLC
2. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Metal-Clad Cable: UL CCN PJAZ, including UL 1569.
4. Standard Features:
   a. Referenced Standard: Article 330 of NFPA 70.
   b. Circuits: Single circuit.
   c. Conductors: Copper, complying with ASTM B3 for bare annealed copper.
   d. Ground Conductor: [**Bare**][**Insulated**][**None**].
   e. Conductor Insulation:
      1) Type TFN/THHN/THWN-2. Comply with UL 83.
      2) Type XHHW-2. Comply with UL 44.
   f. Armor: Steel, interlocked.

2.4 CONNECTORS AND SPLICES

A. UL PJOX - Armored and Metal-Clad Cable Fittings:
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. ABB, Installation Products
   b. Adalet; division of Scott Fetzer Co.
   c. American Fittings Corp. (AMFICO)
   d. Arlington Industries, Inc.
   e. Bridgeport Fittings Inc.
   f. Crouse-Hinds; brand of Eaton, Electrical Sector
   g. Halex; division of Scott Fetzer Co.
   h. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   i. O-Z/Gedney; brand of Appleton Group
   j. Service Wire Co.
   k. SIGMA Engineered Solutions
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Type AC and Type MC Cable Connectors: UL CCN PJOX, including UL 514B.
3. Standard Features: For steel and aluminum sheathed cables, designed to connect conductors specified in this Section.

B. UL ZMVV - Wire Connectors and Soldering Lugs:
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. ABB, Installation Products
   b. Amphenol TPC Wire & Cable
   c. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   d. Eaton
   e. Fastenal Co.
   f. Gardner Bender; brand of ECM Industries LLC; division of nVent Electric plc

g. Hillsdale Terminal
h. Ideal Industries, Inc.
i. ILSCO; brand of ECM Industries LLC; division of nVent Electric plc
j. Marinco Power Products
k. Morris Products Inc.
l. Newark; an Avnet Company
m. Panduit Corp
n. Penn-Union Corp.; subsidiary of Nesco, Inc.
o. TE Connectivity Ltd.

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Wire Connectors and Soldering Lugs: UL CCN ZMVV, including UL 486A-486B or UL 486C.
3. Standard Features:
   a. One piece, seamless, designed to terminate conductors specified in this Section.
   b. Material: Copper.
   c. Type: One hole with standard barrels.
   d. Termination: Crimp.
4.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:
   1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:
   1. Material: Copper.
      a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
      b. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
   1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
   2. Electrical Maintenance: NFPA 70B.
   3. Electrical Safety: NFPA 70E.
   4. Temporary Electric Power Work: NECA NEIS 200.
   5. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
   6. Work in Confined Spaces: NFPA 350.
   7. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
   8. Installation of Type AC and Type MC Cables: NECA NEIS 120.
   9. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:
   1. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
   2. Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables.
   3. 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.
   4. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
   5. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
   6. Provide support for cables.
   7. Connections:
      a. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
      b. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
         1) Utilize twist-on insulated spring connectors for conductor sizes 8 AWG and smaller. Do not use push-in wire connectors.
         2) Utilize mechanical connectors or compression connectors for conductor sizes 6 AWG and larger.
   8. Wiring at Outlets: Install conductor at each outlet, with at least of slack.

D. Interfaces with Other Work:
   1. Identification:
      a. Identify and color-code conductors and cables.
      b. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.
   2. Sleeves and Sleeve Seals: Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
   3. Firestopping: Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Perform manufacturer's recommended tests and inspections.
   2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   3. Perform each of the following visual and electrical tests:
      a. Inspect exposed sections of conductor and cable for physical damage and correct connection in accordance with the single-line diagram.
      b. Test bolted connections for high resistance using one or more of the following:

1) A low-resistance ohmmeter.
2) Calibrated torque wrench.
3) Thermographic survey.

c. Inspect compression-applied connectors for correct cable match and indentation.
d. Inspect for correct identification.
e. Inspect cable jacket and condition.
f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

B. Nonconforming Work:
1. Wire or cable assembly will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Grounding and bonding conductors.
   2. Grounding and bonding clamps.
   3. Grounding and bonding bushings.
   4. Grounding and bonding hubs.
   5. Grounding and bonding connectors.
   6. Intersystem bonding bridge grounding connectors.
   7. Grounding and bonding busbars.
   8. Grounding (earthing) electrodes.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
   2. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
      a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
      b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
      c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are unacceptable for submitted product.

B. Shop Drawings: Prepare and submit the following:
   1. Plans showing dimensioned locations of grounding features described in "Field Quality Control for Grounding and Bonding" Article, including the following:
      a. Grounding electrodes.
      b. Grounding arrangements and connections for separately derived systems.

C. Sustainable Design Submittals:
   1. Product data for sustainable design features for each type of product.

D. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

1.4 SERVICE CONDITIONS FOR ELECTRICAL EQUIPMENT

A. Electrical and ICT Equipment Grounding (Earthing): Do not exceed 5 Ω resistance to ground (earth).
   1. Contact Architect for resolution if 5 Ω specified resistance to ground (earth) is not attained after second attempt to increase effectiveness of grounding (earthing) electrode.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:
   1. Standard Features: 600 V, THHN/THWN-2 or THWN-2, copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. ASTM - Bare Copper Grounding and Bonding Conductor:
   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. ERICO; brand of nVent Electrical plc
      b. Harger Lightning & Grounding; business of Harger, Inc.
   2. Standard Features: Complying with one or more of the following:
      a. Soft or Annealed Copper Wire: ASTM B3.
      b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
      c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
      d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.3 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. UL KDER and KDSH - Hex-Fitting-Type Pipe and Rod Grounding and Bonding Clamp:
   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. ABB Electrification Installations Products
      b. America Fujikura Ltd. (AFL); Fujikura Ltd.
      c. Arlington Industries, Inc.
      d. Cooper B-line; brand of Eaton, Electrical Sector
      e. Crouse-Hinds; brand of Eaton, Electrical Sector
      f. ERICO; brand of nVent Electrical plc
      g. Galvan Industries, Inc.; Electrical Products Division, LLC
      h. Greaves Corp.; Essex Products Group, Inc.
      i. Harger Lightning & Grounding; business of Harger, Inc.
      j. ILSCO; brand of ECM Industries LLC; division of nVent Electric plc
      k. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
      l. Panduit Corp
      m. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   2. Source Limitations: Obtain products from single manufacturer.
   3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
      b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
   4. Standard Features:
      a. Two pieces with [**zinc-plated**][**stainless steel**] bolts.
      b. Clamp Material: [**Silicon bronze**][**Die-cast zinc alloy**][**Aluminum**][**Brass**][**Tinned brass**].
      c. Listed for outdoor use.

C. UL KDER and KDSH - U-Bolt-Type Pipe and Rod Grounding and Bonding Clamp:
   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. ABB Electrification Installations Products
      b. America Fujikura Ltd. (AFL); Fujikura Ltd.
      c. Arlington Industries, Inc.
      d. Cooper B-line; brand of Eaton, Electrical Sector
      e. Crouse-Hinds; brand of Eaton, Electrical Sector
      f. ERICO; brand of nVent Electrical plc
      g. Galvan Industries, Inc.; Electrical Products Division, LLC
      h. Greaves Corp.; Essex Products Group, Inc.
      i. Harger Lightning & Grounding; business of Harger, Inc.
      j. ILSCO; brand of ECM Industries LLC; division of nVent Electric plc
      k. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
      l. Panduit Corp
      m. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   2. Source Limitations: Obtain products from single manufacturer.
   3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
      b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
   4. Standard Features:
      a. Clamp Material: Tinned brass.
      b. Listed for outdoor use.

D. UL KDER and KDSH - Strap-Type Pipe and Rod Grounding and Bonding Clamp:
   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. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      b. Crouse-Hinds; brand of Eaton, Electrical Sector
      c. ERICO; brand of nVent Electrical plc
      d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
      e. Panduit Corp
   2. Source Limitations: Obtain products from single manufacturer.
   3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
      b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
   4. Standard Features:
      a. Clamp Material: Tinned copper.
      b. Listed for outdoor use.

E. UL KDER - Beam Grounding and Bonding Clamp:
   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. ABB Electrification Installations Products
      b. Anderson; brand of Hubbell Utility Solutions; Hubbell Incorporated
      c. Panduit Corp
      d. Penn-Union Corp.; subsidiary of Nesco, Inc.
   2. Source Limitations: Obtain products from single manufacturer.
   3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

4. Standard Features: Mechanical-type, terminal, ground wire access from four directions; with dual, tin-plated or silicon bronze bolts.

F. UL KDER - Exothermically Welded Connection:

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. ABB Electrification Installations Products
b. ALLTEC LLC
c. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated
d. Crouse-Hinds; brand of Eaton, Electrical Sector
e. ERICO; brand of nVent Electrical plc
f. Harger Lightning & Grounding; business of Harger, Inc.
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
4. Standard Features: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

B. UL KDER - Bonding Bushing:

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. ABB Electrification Installations Products
b. Arlington Industries, Inc.
c. Crouse-Hinds; brand of Eaton, Electrical Sector
d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
4. Standard Features: Threaded bushing with insulated throat.

C. UL KDER - Grounding Bushing:

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. ABB Electrification Installations Products
b. Arlington Industries, Inc.
c. Crouse-Hinds; brand of Eaton, Electrical Sector
d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated

2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
4. Standard Features: Threaded bushing with insulated throat and mechanical-type wire terminal.

2.5 GROUNDING AND BONDING HUBS

A. UL KDER - Grounding and Bonding Hub:
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. ABB Electrification Installations Products
    b. Arlington Industries, Inc.
    c. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
    d. Crouse-Hinds; brand of Eaton, Electrical Sector
    e. Greaves Corp.; Essex Products Group, Inc.
    f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
    g. Penn-Union Corp.; subsidiary of Nesco, Inc.
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
4. Standard Features: Insulated, gasketed, watertight hub with mechanical-type wire terminal.

2.6 GROUNDING AND BONDING CONNECTORS

A. UL KDER - Pressure-Type Grounding and Bonding Busbar Cable Connector:
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. ABB Electrification Installations Products
    b. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
    b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
4. Standard Features: Copper or copper alloy, for compression bonding of one or more conductor directly to copper busbar. Listed for direct burial.

B. UL KDER - Lay-In Lug Mechanical-Type Grounding and Bonding Busbar Terminal:
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. ABB Electrification Installations Products
    b. Chatsworth Products, Inc.
    c. Greaves Corp.; Essex Products Group, Inc.
    d. ILSCO; brand of ECM Industries LLC; division of nVent Electric plc
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
    b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
4. Standard Features: Mechanical-type, copper rated for direct burial terminal with set screw.

C. UL KDER - Crimped Lug Pressure-Type Grounding and Bonding Busbar Terminal:
   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. ABB Electrification Installations Products
      b. Harger Lightning & Grounding; business of Harger, Inc.
      c. ILSCO; brand of ECM Industries LLC; division of nVent Electric plc
   2. Source Limitations: Obtain products from single manufacturer.
   3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
      b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
   4. Standard Features: Cast silicon bronze, solderless compression-type wire terminals; with long barrel and two holes spaced on 5/8 or 1 inch centers for two-bolt connection to busbar.

D. UL KDER - Split-Bolt Service-Post Pressure-Type Grounding and Bonding Busbar Terminal:
   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. Panduit Corp
   2. Source Limitations: Obtain products from single manufacturer.
   3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
      b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
   4. Standard Features: Bolts that surround cable and bond to cable under compression when nut is tightened after assembly is screwed into busbar opening.

E. UL KDER - Crimped Pressure-Type Grounding and Bonding Cable Connector:
   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. ABB Electrification Installations Products
      b. allG Fabrication (formerly ALT)
      c. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      d. ILSCO; brand of ECM Industries LLC; division of nVent Electric plc
   2. Source Limitations: Obtain products from single manufacturer.
   3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
      b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
   4. Standard Features: Crimp-and-compress connectors that bond to conductor when connector is compressed around conductor.
      a. Tinned copper, C and H shaped.

F. UL KDER - Split-Bolt Pressure-Type Grounding and Bonding Cable Connector:
   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. ABB Electrification Installations Products
      b. allG Fabrication (formerly ALT)
      c. ERICO; brand of nVent Electrical plc
      d. Greaves Corp.; Essex Products Group, Inc.
   2. Source Limitations: Obtain products from single manufacturer.

3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
    b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
4. Standard Features: Bolts that surround cable and bond to cable under compression when nut is tightened.
    a. Tinned copper.

2.7 GROUNDING AND BONDING BUSBARS

A. Description: Miscellaneous grounding and bonding devices that serve as common connection for multiple grounding and bonding conductors.

B. UL KDER - Equipment Room Grounding and Bonding Busbar:
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. allG Fabrication (formerly ALT)
    b. Chatsworth Products, Inc.
    c. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated
    d. Cooper B-line; brand of Eaton, Electrical Sector
    e. ERICO; brand of nVent Electrical plc
    f. Harger Lightning & Grounding; business of Harger, Inc.
    g. Hoffman; brand of nVent Electrical plc
    h. ILSCO; brand of ECM Industries LLC; division of nVent Electric plc
    i. Panduit Corp
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
4. Standard Features:
    a. Bus: Rectangular bar of annealed copper.
    b. Mounting Stand-Off Insulators: Lexan or PVC.
        1) Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.
5. Other Available Features Required by the Project:
    a. Dimensions: 1/4 by 4 inch in cross section; length as indicated on the Drawings.
    b. Predrilled Hole Pattern: 9/32 inch holes spaced 1-1/8 inch apart.
    c. Mounting Hardware: Stand-off brackets that provide 2 inch clearance to access rear of bus. Brackets and bolts must be stainless steel.

2.8 GROUNDING (EARTHING) ELECTRODES

A. UL KDER - Rod Electrode:
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. ABB Electrification Installations Products
    b. allG Fabrication (formerly ALT)
    c. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated
    d. ERICO; brand of nVent Electrical plc
    e. Galvan Industries, Inc.; Electrical Products Division, LLC
    f. Harger Lightning & Grounding; business of Harger, Inc.
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

4. Standard Features: [**Copper-clad**] [**Zinc-coated**] [**Stainless**] steel[**, sectional type**]; 3/4 inch by 10 ft.

B. UL KDER - Plate Electrode:
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. ALLTEC LLC
   b. Galvan Industries, Inc.; Electrical Products Division, LLC
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
4. Standard Features: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of electrical service equipment connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF GROUNDING AND BONDING PRODUCTS

A. Grounding and Bonding Conductors:
1. Provide solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
2. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
3. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
7. Underground Grounding Conductors: Install bare tinned-copper conductor, 2/0 AWG minimum.

B. Grounding and Bonding Connectors:
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.

C. Grounding and Bonding Busbars: Provide in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated on the Drawings.

3.3 INSTALLATION OF GROUNDING AND BONDING

A. Comply with manufacturer's published instructions.

B. Reference Standards:
1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Maintenance: NFPA 70B.

3. Electrical Safety: NFPA 70E.
4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
5. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:
1. Grounding and Bonding Conductors:
   a. 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. Underground Grounding Conductors:
      1) Bury at least 30 inch below grade.
      2) Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.
2. Grounding and Bonding Connectors: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
   a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
   b. Make connections with clean, bare metal at points of contact.
   c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
   d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
   f. 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 adjacent parts.
      2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
      3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.
   g. 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; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where 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 bolted connector.
      3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
   h. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft apart.
3. Grounding and Bonding Busbars:
   a. Install busbar horizontally, on insulated spacers 2 inch minimum from wall, 6 inch above finished floor unless otherwise indicated.
   b. Where busbars are indicated on both sides of doorways, route bonding conductor up to top of door frame, across top of doorway, and down; connect to continuation of horizontal busbar.
4. Electrodes:
   a. Ground Rods: Drive rods until tops are 2 inch 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) Use exothermic welds for below-grade connections.

b. Concrete-Encased Electrode (Ufer Ground):
1) Fabricate in accordance with NFPA 70; use minimum of 20 ft of bare copper conductor not smaller than 4 AWG.
a) If concrete foundation is less than 20 ft long, coil excess conductor within base of foundation.
b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

5. Grounding at Service:
a. Equipment grounding conductors and grounding electrode conductors must be connected to ground busbar. Install main bonding jumper between neutral and ground buses.

6. Grounding Separately Derived Systems:
a. Permanent Generators: Install grounding electrode(s) at location of permanent generators having switched neutral connections. Electrode must be connected to equipment grounding conductor and to frame of generator.

7. Equipment Grounding and Bonding:
a. Install insulated equipment grounding conductors with 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 switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
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: Install 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. Poles Supporting Outdoor Lighting Fixtures: Bond insulated equipment grounding conductor to equipment grounding terminal inside pole base.

3.4 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING

A. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal , and at individual ground rods. Make tests at ground rods before conductors are connected.
a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by 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 in accordance with IEEE Std 81.
c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

B. Nonconforming Work:
1. Grounding system will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective components and retest.

C. Collect, assemble, and submit test and inspection reports.

3.5 PROTECTION

A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260526

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Support systems.
   2. Mounting, anchoring, and attachment components.
   3. Installation of fabricated metal supports.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.

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 the following:
      a. Slotted support systems, hardware, and accessories.
      b. Clamps.
      c. Hangers.
      d. Sockets.
      e. Eye nuts.
      f. Fasteners.
      g. Anchors.
      h. Saddles.
      i. Brackets.
   2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
   1. Hangers. Include product data for components.
   2. Slotted support systems.
   3. Equipment supports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame Rating: Class 1.
   2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT SYSTEMS

A. Steel Slotted Support Systems:
   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. ABB Electrification Installations Products
      b. Allied Tube & Conduit; Atkore International
      c. Atkore Unistrut
      d. CADDY; brand of nVent Electrical plc
      e. Cooper B-line; brand of Eaton, Electrical Sector
      f. Flex-Strut Inc.
      g. G-Strut
      h. Gripple Inc.
      i. Haydon Corporation

j. Metal Ties Innovation
k. MIRO Industries Inc.
l. Rocket Rack; Robroy Industries
m. Wesanco/ZSi-Foster; an Ideal Tridon Group Company

2. Standard Features: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
   a. Referenced Standard: MFMA-4 factory-fabricated components for field assembly.
   b. Material for Channel, Fittings, and Accessories: Galvanized steel.
   c. Channel Width: Selected for applicable load criteria.
   d. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   e. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   f. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

B. Aluminum Slotted Support Systems:
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. ABB Electrification Installations Products
   b. Atkore Unistrut
   c. Eaton
   d. Flex-Strut Inc.
   e. Haydon Corporation
   f. MKT Metal Manufacturing
2. Standard Features: Extruded-aluminum channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
   a. Referenced Standard: MFMA-4 factory-fabricated components for field assembly.
   b. Channel Material: 6063-T5 aluminum alloy.
   c. Fittings and Accessories Material: 5052-H32 aluminum alloy.
   d. Channel Width: Selected for applicable load criteria.
   e. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   f. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

C. Conduit and Cable Support Devices:
1. Standard Features: hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit:
1. Standard Features: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.

E. Structural Steel for Fabricated Supports and Restraints:
1. Standard Features: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

2.3 MOUNTING, ANCHORING, AND ATTACHMENT COMPONENTS

A. Mechanical-Expansion Anchors:
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. Cooper B-line; brand of Eaton, Electrical Sector
   b. Empire Industries, Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
   e. MKT Fastening, LLC

2. Standard Features: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

B. Clamps for Attachment to Steel Structural Elements:
1. Standard Features: MSS SP-58 units are suitable for attached structural element.

C. Through Bolts:
1. Standard Features: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.

D. Toggle Bolts:
1. Standard Features: All steel springhead type.

E. Hanger Rods:
1. Standard Features: Threaded steel.

PART 3 - EXECUTION

3.1 SELECTION OF HANGERS AND SUPPORTS

A. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as scheduled in NECA NEIS 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size must be 1/4 inch in diameter.

B. 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 single-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

C. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Hot Work: NFPA 51B.
3. Work in Confined Spaces: NFPA 350.
4. Installation of Steel Conduit: NECA NEIS 101.
5. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:
1. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT IMC and ERMC may be supported by openings through structure members, in accordance with NFPA 70.
2. 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 must be weight of supported components plus 200 lb.
3. 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:
a. To Wood: Fasten with lag screws or through bolts.
b. To New Concrete: Bolt to concrete inserts.
c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

d. To Existing Concrete: Expansion anchor fasteners.
e. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
f. To Light Steel: Sheet metal screws.
g. 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 comply with seismic-restraint strength and anchorage requirements.

4. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

D. Interfaces with Other Work:
1. Provide vibration controls with hangers and supports.
2. Touchup Finishes:
a. 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. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
c. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.
3. Installation of Fabricated Metal Supports:
a. Provide site-fabricated metal supports.
b. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
c. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

END OF SECTION 260529

SECTION 260533.13 - CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Type EMT duct raceways and elbows.
2. Type ERMC duct raceways, elbows, couplings, and nipples.
3. Type FMC duct raceways.
4. Type IMC duct raceways.
5. Type LFMC duct raceways.
6. Type PVC duct raceways and fittings.
7. Fittings for conduit, tubing, and cable.
8. Joint compounds.
9. Solvent cements.

B. Related Requirements:
1. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
2. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" specifies nonmetallic underground conduit with conductors (Type NUCC).
3. Section 260529 "Hangers and Supports for Electrical Systems" specifies conduit hangers and supports referenced by this Section.
4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Raceway Types:
1. EMT: Electrical metallic tubing.
2. EMT-A: Aluminum electrical metallic tubing.
3. EMT-S: Steel electrical metallic tubing.
4. EMT-SS: Stainless steel electrical metallic tubing.
5. ERMC: Electrical rigid metal conduit.
6. ERMC-A: Aluminum electrical rigid metal conduit.
7. ERMC-S: Steel electrical rigid metal conduit.
8. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
9. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
10. ERMC-SS: Stainless steel electrical rigid metal conduit.
11. FMC: Flexible metal conduit.
12. FMC-A: Aluminum flexible metal conduit.
13. FMC-S: Steel flexible metal conduit.
14. IMC: Steel electrical intermediate metal conduit.
15. LFMC: Liquidtight flexible metal conduit.
16. LFMC-A: Aluminum liquidtight flexible metal conduit.
17. LFMC-S: Steel liquidtight flexible metal conduit.
18. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
19. LFNC: Liquidtight flexible nonmetallic conduit.
20. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
21. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
22. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
23. PVC: Rigid PVC conduit.
24. PVC-40: Schedule 40 rigid PVC conduit.
25. PVC-80: Schedule 80 rigid PVC Conduit.
26. PVC-A: Type A rigid PVC concrete-encased conduit.

27. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
28. RGS: See ERMC-S-G.
29. RMC: See ERMC.

B. Definitions:
1. Conduit: A structure containing one or more duct raceways.
2. Direct Buried: Installed underground without encasement in concrete or other protective material.
3. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.
4. Duct Raceway: A single enclosed raceway for conductors or cable.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Unless indicated otherwise on drawings, minimum conduit sizes shall be as listed for each conduit type.

2.2 TYPE EMT DUCT RACEWAYS AND ELBOWS

A. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:
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. Allied Tube & Conduit; Atkore International
b. Calconduit; Atkore International
c. Emerson Electric Co., Automation Solutions
d. Picoma; Zekelman Industries
e. Republic Conduit; Nucor Corporation, Nucor Tubular Products
f. Topaz Lighting & Electric
g. Western Tube; Zekelman Industries
h. Wheatland Tube; Zekelman Industries
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. UL CCN FJMX; including UL 797.
3. Standard Features:
a. Material: Steel.
b. Exterior Coating: Zinc.
c. Interior Coating: Zinc.
d. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.3 TYPE ERMC DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. UL DYIX - Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:
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. Allied Tube & Conduit; Atkore International
b. Calconduit; Atkore International

c. Crouse-Hinds; brand of Eaton, Electrical Sector
d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
e. Patriot Aluminum Products, LLC
f. Republic Conduit; Nucor Corporation, Nucor Tubular Products
g. Rymco USA brand; manufactured and listed by subsidiary Conduit S.A. de C.V
h. Topaz Lighting & Electric
i. Western Tube; Zekelman Industries
j. Wheatland Tube; Zekelman Industries

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN DYIX; including UL 6.
3. Standard Features:
   a. Exterior Coating: Zinc.
   b. Interior Coating: Zinc.
   c. Minimum Trade Size: Metric designator 21 (trade size 3/4).

B. UL DYIX - PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:
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. ABB Electrification Installations Products
   b. Bluesteel Services LLC
   c. Calbond; Atkore International
   d. KorKap; Robroy Industries
   e. Perma-Cote; Robroy Industries
   f. Plasti-Bond; Robroy Industries
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN DYIX; including UL 6.
3. Standard Features:
   a. Exterior Coating: PVC complying with NEMA RN 1.
   b. Interior Coating: Zinc.
   c. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.4 TYPE FMC DUCT RACEWAYS

A. UL DXUZ - Steel Flexible Metal Conduit (FMC-S):
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. ABB Electrification Installations Products
   b. Anaconda Sealtite; Anamet Electrical, Inc
   c. Electri-Flex Company
   d. International Metal Hose Co.
   e. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway
   f. Topaz Lighting & Electric
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN DXUZ; including UL 1.
3. Standard Features:
   a. Material: Steel.
   b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.5 TYPE IMC DUCT RACEWAYS

A. UL DYBY - Steel Intermediate Metal Conduit (IMC):
   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. ABB Electrification Installations Products
      b. Allied Tube & Conduit; Atkore International
      c. Calconduit; Atkore International
      d. Republic Conduit; Nucor Corporation, Nucor Tubular Products
      e. Rymco USA brand; manufactured and listed by subsidiary Conduit S.A. de C.V
      f. Topaz Lighting & Electric
      g. Western Tube; Zekelman Industries
      h. Wheatland Tube; Zekelman Industries
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. UL CCN DYBY; including UL 1242.
   3. Standard Features:
      a. Exterior Coating: Zinc.
      b. Interior Coating: Zinc.
      c. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.6 TYPE LFMC DUCT RACEWAYS

A. UL DXHR - Steel Liquidtight Flexible Metal Conduit (LFMC-S):
   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. ABB Electrification Installations Products
      b. Anaconda Sealtite; Anamet Electrical, Inc
      c. Electri-Flex Company
      d. International Metal Hose Co
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. UL CCN DXHR; including UL 360.
   3. Standard Features:
      a. Material: Steel.
      b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.7 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. UL DZYR - Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
   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. ABB Electrification Installations Products
      b. Calconduit; Atkore International
      c. JM Eagle
      d. NAPCO; Westlake Chemical Corp.
      e. National Pipe and Plastic, Inc. (Oldcastle)
      f. Opti-Com Manufacturing Network, Inc (OMNI)
      g. Topaz Lighting & Electric
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. UL CCN DZYR; including UL 651.
   3. Standard Features:
      a. Dimensional Specifications: Schedule 40.
      b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

c. Markings: For use with maximum 90 deg C wire.

B. UL DZYR - Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
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. ABB Electrification Installations Products
b. Calconduit; Atkore International
c. JM Eagle
d. National Pipe and Plastic, Inc. (Oldcastle)
e. Opti-Com Manufacturing Network, Inc (OMNI)
f. Topaz Lighting & Electric
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. UL CCN DZYR; including UL 651.
3. Standard Features:
a. Dimensional Specifications: Schedule 80.
b. Minimum Trade Size: Metric designator 21 (trade size 3/4).
c. Markings: For use with maximum 90 deg C wire.

C. UL DZYR - Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings:
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. Southern Pipe, Inc.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. UL CCN DZYR; including UL 651.
3. Standard Features:
a. Dimensional Specifications: Type A.
b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

D. UL DZYR - Type EB Rigid PVC Concrete-Encased Underground Conduit (PVC-EB) and Fittings:
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. JM Eagle
b. Southern Pipe, Inc.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. UL CCN DZYR; including UL 651.
3. Standard Features:
a. Dimensional Specifications: Type EB.
b. Minimum Trade Size: Metric designator 53 (trade size 2).

2.8 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. UL DWTT - Fittings for Type ERMC, Type IMC, and Type PVC Duct Raceways:
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. ABB Electrification Installations Products
b. Appleton; Emerson Electric Co., Automation Solutions
c. Crouse-Hinds; brand of Eaton, Electrical Sector
d. Konkore Fittings; Atkore International
e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
f. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway
g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated

h. Southwire Company, LLC
i. Topaz Lighting & Electric

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN DWTT; including UL 514B.
3. Standard Features:
   a. Type ERMC and IMC
      1) Material: Steel.
      2) Coupling Method: Use threaded fittings only.
   b. Type PVC
      1) Material: PVC

B. UL FKAV - Fittings for Type EMT Duct Raceways:
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. ABB Electrification Installations Products
   b. Allied Tube & Conduit; Atkore International
   c. Appleton; Emerson Electric Co., Automation Solutions
   d. Calconduit; Atkore International
   e. Crouse-Hinds; brand of Eaton, Electrical Sector
   f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
   g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   h. Southwire Company, LLC
   i. Topaz Lighting & Electric
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN FKAV; including UL 514B.
3. Standard Features:
   a. Material: Steel.
   b. Coupling Method: Compression coupling or setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.
   c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

C. UL ILNR - Fittings for Type FMC Duct Raceways:
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 Fittings Corp. (AMFICO)
   b. Liquid Tight Connector Co.
   c. Southwire Company, LLC
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN ILNR; including UL 514B.

D. UL DXAS - Fittings for Type LFMC Duct Raceways:
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. Arlington Industries, Inc.
   b. Liquid Tight Connector Co.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN DXAS; including UL 514B.

2.9 JOINT COMPOUNDS

A. UL FOIZ - Electrically Conductive Corrosion-Resistant Compound for Threaded Conduit:
   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. ABB Electrification Installations Products
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. UL CCN FOIZ; including UL Subject 2419.

2.10 SOLVENT CEMENTS

A. UL VBEW - Solvent Cements for Nonmetallic Duct Raceways and Fittings:
   1. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Solvent Cements: UL CCN VBEW; including UL 340.
      b. Solvent Cement Compatibility with PVC Conduit Fittings: UL CCN DWTT; including UL 514B. Follow solvent manufacturer's published instructions.
      c. Solvent Cement Compatibility with Rigid PVC Conduit: UL CCN DZYR; including UL 651. Follow solvent manufacturer's published instructions.

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in the Contract Documents or manufacturer's published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:
   1. Exposed and Subject to Severe Physical Damage: ERMC.
   2. Exposed and Subject to Physical Damage: ERMC or IMC.
   3. Exposed and Not Subject to Physical Damage: ERMC, IMC, or PVC-80.
   4. Concealed Aboveground: ERMC, IMC, EMT, PVC-80, or PVC-40.
   5. Direct Buried: PVC-80.
   6. Concrete Encased: PVC-80 or PVC-40.
   7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:
   1. Exposed and Subject to Severe Physical Damage: ERMC.
   2. Exposed and Subject to Physical Damage: ERMC or IMC.
   3. Exposed and Not Subject to Physical Damage: ERMC, IMC, or .
   4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   5. Damp or Wet Locations: Corrosion-resistant EMT.
   6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

D. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
   1. ERMC and IMC: Provide threaded-type fittings unless otherwise indicated.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
   1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.

2. Electrical Safety: NFPA 70E.
3. Commissioning of Active and Passive Fire Protection Features: NFPA 3 and NFPA 4.
4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
5. Communications Work: BICSI N1.
6. Life Safety and Means of Egress Work: NFPA 101.
7. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
8. Work in Confined Spaces: NFPA 350.
9. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
10. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
11. Type ERMC-S: Article 344 of NFPA 70 and NECA NEIS 101.
12. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
13. Type IMC: Article 342 of NFPA 70 and NECA NEIS 101.
14. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
15. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
16. Expansion Fittings: NEMA FB 2.40.
17. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:
1. General Requirements for Installation of Duct Raceways:
    a. Complete duct raceway installation before starting conductor installation.
    b. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
    c. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inch of changes in direction.
    d. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
    e. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
    f. Support conduit within 12 inch of enclosures to which attached.
    g. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.
    h. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:
        1) Where an underground service duct raceway enters a building or structure.
        2) Conduit extending from interior to exterior of building.
        3) Where otherwise required by NFPA 70.
    i. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
    j. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
    k. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.
    l. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
        1) Termination fittings with shoulders do not require two locknuts.
    m. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger

conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

2. Types ERMC and IMC:
   a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.
3. Type ERMC-S-PVC:
   a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
   b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMC-S-PVC elbows in direct-burial applications. PVC-coated sealing locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMC-S-PVC duct raceway.
   c. Coat field-cut threads on PVC-coated duct raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.
4. Types FMC, LFMC:
   a. Provide a maximum of 72 inch of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
5. Type PVC:
   a. Do not install Type PVC conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
   b. Comply with manufacturer's published instructions for solvent welding and fittings.
   c. Join joints with solvent cement in accordance with manufacturer's published instructions and allowed to cure before handling. Joints to be bent, pushed, or pulled must set for minimum 24 h after joining.
6. Duct Raceways Embedded in Slabs:
   a. .
   b. Do not embed conduit in concrete slabs. Route raceways below slabs.
   c. Change from PVC to ERMC or IMC before rising above floor.
7. Stub-ups to Above Recessed Ceilings:
   a. Provide EMT, IMC, or ERMC for duct raceways.
   b. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
8. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:
   a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG. Install insulated throat metal grounding bushings on service conduits.
9. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
   a. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   b. EMT: Provide setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
   c. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
10. Duct Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal duct raceway openings on both sides of rooms or walls with acoustically rated putty.
11. Identification: Provide labels for conduit assemblies, duct raceways, and associated electrical equipment.

D. Interfaces with Other Work:
   1. Firestop penetrations of fire-rated floor and wall assemblies.
   2. Provide conduit hangers and supports.

3.3 FIELD QUALITY CONTROL OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Tests and Inspections:
   1. Perform manufacturer's recommended tests and inspections.
   2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
   3. Conduit Placement:
      a. Verify that center-line location and offsets are in accordance with the Drawings.
      b. Verify that hangers and supports for conduits are attached to structure.
      c. Verify that nuts on bolts or hanger rods are secure.
      d. Verify that space between raceways and cored holes are filled with non-shrinking grout or other approved material indicated on the Drawings and the Specifications.
      e. Verify that expansion devices are installed at locations indicated on the Drawings and the Specifications.
      f. Verify that ends are cut square to provide flush-butting surfaces when spliced and inside edges are free of burrs that could impede installation of cables.
      g. Verify minimum separation of utilities, or that approved mechanical protection has been provided to surrounding conduit(s) where minimum separation cannot be achieved.

B. Nonconforming Work:
   1. Conduit will be considered defective if it does not pass tests and inspections.
   2. Remove and replace defective units and retest.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.4 CLEANING

A. Verify that bentonite or other drilling fluids are contained and removed, and site is restored to its original or improved condition.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533.13

SECTION 260533.16 - BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metallic outlet boxes, device boxes, rings, and covers.
   2. Junction boxes and pull boxes.
   3. Cover plates for device boxes.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
   2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
   3. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.

1.2 DEFINITIONS

A. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
   1. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
   2. Concrete Box: A box intended for use in poured concrete.
   3. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
   4. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
   5. Cover Plate: A cover designed for protecting wiring devices installed in flush-mounted device boxes while permitting their safe operation; also called a faceplate or wallplate.
   6. Device Box: A box with provisions for mounting a wiring device directly to the box.
   7. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
   8. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
   9. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
   10. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
   11. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
   12. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
   13. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
   14. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.

B. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.

C. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of product requiring samples for source quality control.

C. Shop Drawings: Prepare and submit the following:
1. Shop Drawings for Floor Boxes: Show that floor boxes are located to avoid interferences and are structurally allowable.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. .

2.2 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. UL QCIT - Metallic Outlet Boxes and Covers:
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. ABB Electrification Installations Products
   b. Appleton; Emerson Electric Co., Automation Solutions
   c. Arlington Industries, Inc.
   d. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   e. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   f. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   g. MonoSystems, Inc
   h. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
   i. Pass & Seymour; Legrand North America, LLC
   j. Patriot Aluminum Products, LLC
   k. Plasti-Bond; Robroy Industries
   l. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   m. Spring City Electrical Manufacturing Company
   n. Topaz Lighting & Electric
   o. Wiremold; Legrand North America, LLC
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN QCIT; including UL 514A.
3. Standard Features:
   a. Box having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
   b. Material: Sheet steel or cast metal.
   c. Sheet Metal Depth: Minimum 2 inch.
   d. Cast-Metal Depth: Minimum 2.4 inch.
4. Other Available Features Required by the Project:
   a. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.

B. UL QCIT - Metallic Conduit Bodies:
   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. ABB Electrification Installations Products
      b. Appleton; Emerson Electric Co., Automation Solutions
      c. Crouse-Hinds; brand of Eaton, Electrical Sector
      d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
      f. Pass & Seymour; Legrand North America, LLC
      g. Patriot Aluminum Products, LLC
      h. Plasti-Bond; Robroy Industries
      i. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      j. Topaz Lighting & Electric
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. UL CCN QCIT; including UL 514A.
   3. Standard Features: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

C. UL QCIT - Metallic Device Boxes:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. ABB Electrification Installations Products
      b. Appleton; Emerson Electric Co., Automation Solutions
      c. Arlington Industries, Inc.
      d. Crouse-Hinds; brand of Eaton, Electrical Sector
      e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      g. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      h. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
      i. Patriot Aluminum Products, LLC
      j. Plasti-Bond; Robroy Industries
      k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      l. Topaz Lighting & Electric
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. UL CCN QCIT; including UL 514A.
   3. Standard Features:
      a. Box with provisions for mounting wiring device directly to box.
      b. Material: [**Sheet steel**][**Sheet aluminum**][**Cast metal**].
      c. Sheet Metal Depth: minimum 2 inch.
      d. Cast-Metal Depth: minimum 2.4 inch.

D. UL QCIT - Metallic Extension Rings:
   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. ABB Electrification Installations Products
      b. Appleton; Emerson Electric Co., Automation Solutions
      c. Cooper B-line; brand of Eaton, Electrical Sector
      d. Crouse-Hinds; brand of Eaton, Electrical Sector
      e. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
      f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group

g. Pass & Seymour; Legrand North America, LLC
h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
i. Topaz Lighting & Electric

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN QCIT; including UL 514A.
3. Standard Features: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
4. Sustainable Design Features:
   a. Corporate Sustainability Report: Provide [**third-party-verified**]corporate sustainability report that is publicly available from manufacturer and that includes environmental impacts of extraction operations and activities associated with product and its supply chain.
   b. Regional Materials (LEED): Provide documentation if product is sourced (extracted, manufactured, or purchased) within **100 miles** of Project site.
   c. Regional Materials (IgCC/ASHRAE 189.1): Provide documentation if product is sourced (extracted, harvested, recovered, or manufactured) within **500 miles** of Project site. Identify percentage of product's travel that is by rail or water.
   d. Third-Party Certification: Third-party certification, in accordance with multiple attribute standard(s) developed by consensus-based process from an approved standard development organization, is publicly available for product.
   e. Third-Party-Verified Product Life-Cycle Assessment: Assessment covering cradle-to-gate scope, in accordance with ISO 14040 and ISO 14044, is publicly available for product.

E. UL QCIT - Metallic Floor Boxes and Floor Box Covers:
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. ABB Electrification Installations Products
   b. AFC Cable Systems; Atkore International
   c. Arlington Industries, Inc.
   d. Eaton, Wiring Devices; Arrow Hart
   e. FSR Inc.
   f. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   h. Leviton Manufacturing Co., Inc.
   i. Pass & Seymour; Legrand North America, LLC
   j. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   k. Wiremold; Legrand North America, LLC
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN QCIT; including UL 514A.
3. Standard Features: Box mounted in floor with floor box cover and other components to complete floor box enclosure.

F. UL QCIT - Metallic Concrete Boxes and Covers:
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. ABB Electrification Installations Products
   b. Crouse-Hinds; brand of Eaton, Electrical Sector
   c. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   e. Topaz Lighting & Electric
   f. Wiremold; Legrand North America, LLC

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. UL CCN QCIT; including UL 514A.
3. Standard Features: Box intended for use in poured concrete.

2.3 JUNCTION BOXES AND PULL BOXES

A. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Adalet; division of Scott Fetzer Co.
    b. Appleton; Emerson Electric Co., Automation Solutions
    c. Cooper B-line; brand of Eaton, Electrical Sector
    d. FSR Inc.
    e. Hoffman; brand of nVent Electrical plc
    f. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated
    g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
    h. Milbank Manufacturing Company
    i. N J Sullivan Company
    j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
    k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
    l. Spring City Electrical Manufacturing Company
    m. Square D; Schneider Electric USA
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. UL CCN BGUZ; including UL 50 and UL 50E.
3. Standard Features:
    a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

B. UL BGUZ - Indoor Cast-Metal Junction and Pull Boxes:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Adalet; division of Scott Fetzer Co.
    b. Appleton; Emerson Electric Co., Automation Solutions
    c. Crouse-Hinds; brand of Eaton, Electrical Sector
    d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. UL CCN BGUZ; including UL 50 and UL 50E.
3. Standard Features:
    a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

C. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Adalet; division of Scott Fetzer Co.
    b. Appleton; Emerson Electric Co., Automation Solutions
    c. Cooper B-line; brand of Eaton, Electrical Sector
    d. FSR Inc.
    e. Hoffman; brand of nVent Electrical plc
    f. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated

g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
h. Milbank Manufacturing Company
i. N J Sullivan Company
j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
l. Spring City Electrical Manufacturing Company
m. Square D; Schneider Electric USA

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN BGUZ; including UL 50 and UL 50E.
3. Standard Features:
   a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

D. UL BGUZ - Outdoor Cast-Metal Junction and Pull Boxes:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Adalet; division of Scott Fetzer Co.
   b. Appleton; Emerson Electric Co., Automation Solutions
   c. Crouse-Hinds; brand of Eaton, Electrical Sector
   d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN BGUZ; including UL 50 and UL 50E.
3. Standard Features:
   a. Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2.4 COVER PLATES FOR DEVICE BOXES

A. UL QCIT or QCMZ - Nonmetallic Cover Plates for Device Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eaton, Wiring Devices; Arrow Hart
   b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour; Legrand North America, LLC
2. Coverplates shall be provided by wiring device manufacturer to ensure color continuity.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. UL CCN QCIT or UL CCN QCMZ; including UL 514D.
4. Standard Features:
   a. Cover Plate-Securing Screws: Metal with head color to match cover plate finish.
   b. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
   c. Cover Plate Material: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device.

PART 3 - EXECUTION

3.1 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:
   1. Outdoors:
      a. Type 3R unless otherwise indicated.
      b. Locations Exposed to Hosedown: Type 4X.
   2. Indoors:
      a. Type 1 unless otherwise indicated.
      b. Locations Exposed to Hosedown: Type 4.

C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
   1. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.2 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
   1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
   2. Electrical Safety: NFPA 70E.
   3. Commissioning of Active and Passive Fire Protection Features: NFPA 3 and NFPA 4.
   4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
   5. Life Safety and Means of Egress Work: NFPA 101.
   6. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
   7. Work in Confined Spaces: NFPA 350.
   8. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
   9. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
   10. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:
   1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
   2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to [**center**][**top**][**bottom**] of box unless otherwise indicated.
   3. 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. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
   4. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
   5. Locate boxes so that cover or plate will not span different building finishes.
   6. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
   7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
   8. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
   9. Set metal floor boxes level and flush with finished floor surface.
   10. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
   11. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
   12. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
b. Provide gaskets for cover plates and covers.

D. Interfaces with Other Work:
1. Identification: Provide labels for boxes and associated electrical equipment.
a. Identify field-installed conductors, interconnecting wiring, and components.
b. Label each enclosure with engraved metal or laminated-plastic nameplate.
c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.

3.3 CLEANING

A. Remove construction dust and debris from boxes before installing cover plates, covers, and hoods.

3.4 PROTECTION

A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260533.16

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Round sleeves.
   2. Sleeve-seal systems.
   3. Sleeve-seal fittings.
   4. Grout.
   5. Pourable sealants.
   6. Foam sealants.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Steel Wall Sleeves:
   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. Advance Products & Systems, LLC
      b. CCI Piping Systems
      c. Flexicraft Industries
      d. GPT; a division of EnPRO Industries
      e. Specified Technologies Inc.
   2. General Characteristics: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. Cast-Iron Wall Sleeves:
   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 Cast Iron Pipe Company
      b. Flexicraft Industries
      c. McWane Ductile; a part of the McWane family of companies
   2. General Characteristics: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Advance Products & Systems, LLC
   2. American Polywater Corporation
   3. BWM Company
   4. CALPICO, Inc.
   5. Flexicraft Industries
   6. GPT; a division of EnPRO Industries
   7. Metraflex Company (The)
   8. Proco Products, Inc

9. Roxtec Inc.

B. General Characteristics: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

C. Options:
1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

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. Holdrite; a division of Reliance Worldwide Corporation

B. General Characteristics: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit must have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. General Characteristics: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000 psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.5 POURABLE SEALANTS

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. Carlisle Syntec Systems
2. GAF
3. Johns Manville; a Berkshire Hathaway company
4. Specified Technologies Inc.

B. Performance Criteria:
1. General Characteristics: Single-component, neutral-curing elastomeric sealants of grade indicated below.
a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.6 FOAM SEALANTS

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. Innovative Chemical Products (Building Solutions Group)
2. The Dow Chemical Company

B. Performance Criteria:
1. General Characteristics: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4 inch annular clear space between sleeve and raceway or cable, unless sleeve-seal system is to be installed.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for wall assemblies.

C. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve-seal systems. Size sleeves to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

D. Underground, Exterior-Wall and Floor Penetrations:
   1. Install steel pipe sleeves. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Labels.
   2. Extruded insulating tubing.
   3. Bands.
   4. Tapes and stencils.
   5. Tags.
   6. Signs.
   7. Cable ties.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
   2. Section 284600 "Fire Detection and Alarm" specifies fire detection and alarm devices referenced in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 LABELS

A. Performance Criteria:
   1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
   2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.

B. UL PGDQ2 - Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brady Corporation
      b. Champion America
      c. emedco
      d. Grafoplast Wire Markers
      e. HellermannTyton
      f. LEM Products Inc.
      g. Marking Services Inc.
      h. Panduit Corp
      i. Seton Identification Products; a Brady Corporation company

C. UL PGDQ2 - Self-Adhesive Wraparound Labels: Preprinted, 3 mil thick, flexible label with acrylic pressure-sensitive adhesive.

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'n D Cable Products
    b. Brady Corporation
    c. Brother International Corporation
    d. emedco
    e. Grafoplast Wire Markers
    f. Ideal Industries, Inc.
    g. LEM Products Inc.
    h. Marking Services Inc.
    i. Panduit Corp
    j. Seton Identification Products; a Brady Corporation company
2. Self-Lamination: Clear; UV-, weather-, and chemical-resistant; self-laminating, with protective shield over legend. Size labels such that clear shield overlaps entire printed legend.
3. Marker for Labels:
    a. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. UL PGDQ2 - Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3 mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
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'n D Cable Products
    b. Brady Corporation
    c. Brother International Corporation
    d. emedco
    e. Grafoplast Wire Markers
    f. HellermannTyton
    g. Ideal Industries, Inc.
    h. LEM Products Inc.
    i. Marking Services Inc.
    j. Panduit Corp
    k. Seton Identification Products; a Brady Corporation company
    l. <**Insert manufacturer's name**>
2. Minimum Nominal Size:
    a. 1-1/2 by 6 inch for raceway and conductors.
    b. 3-1/2 by 5 inch for equipment.
    c. As required by authorities having jurisdiction.

2.2 EXTRUDED INSULATING TUBING

A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN YDPU2 for components; including UL 224.

B. UL YDPU2 - Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Brady Corporation
    b. Panduit Corp

2.3 BANDS

A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Brady Corporation
    b. HellermannTyton
    c. Marking Services Inc.
    d. Panduit Corp
    e. Seton Identification Products; a Brady Corporation company

B. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch long, with diameters sized to suit diameters and that stay in place by gripping action.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Brady Corporation
    b. HellermannTyton
    c. Marking Services Inc.
    d. Panduit Corp

2.4 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Brady Corporation
    b. Carlton Industries, LP
    c. Champion America
    d. HellermannTyton
    e. Ideal Industries, Inc.
    f. Marking Services Inc.
    g. Panduit Corp

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil thick by 1 to 2 inch wide; compounded for outdoor use.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Brady Corporation
    b. Carlton Industries, LP
    c. emedco
    d. Marking Services Inc.

C. Tape and Stencil: 4 inch wide black stripes on 10 inch centers placed diagonally over orange background and are 12 inch wide. Stop stripes at legends.
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. HellermannTyton
    b. LEM Products Inc.
    c. Marking Services Inc.
    d. Pipemarker.com; Brimar Industries, Inc.
    e. Seton Identification Products; a Brady Corporation company

D. Floor Marking Tape: 2 inch wide, 5 mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Brady Corporation
    b. Carlton Industries, LP
    c. Seton Identification Products; a Brady Corporation company

E. Underground-Line Warning Tape:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Brady Corporation
   b. Ideal Industries, Inc.
   c. LEM Products Inc.
   d. Marking Services Inc.
   e. Pipemarker.com; Brimar Industries, Inc.
   f. Reef Industries, Inc.
   g. Seton Identification Products; a Brady Corporation company
2. Tape:
   a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical utility lines.
   b. Printing on tape must be permanent and may not be damaged by burial operations.
   c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
   a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.
   b. Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW".
4. Nonconducting Line-Warning Tape :
   a. Pigmented polyolefin, bright colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
   b. Width: 3 inch.
   c. Thickness: 4 mil.
   d. Weight: 18.5 lb/1000 sq. ft.
   e. Tensile in accordance with ASTM D882: 30 lbf and 2500 psi.
5. Reinforced Nonconducting Line-Warning Tape :
   a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
   b. Width: 3 inch.
   c. Thickness: 12 mil.
   d. Weight: 36.1 lb/1000 sq. ft.
   e. Tensile in accordance with ASTM D882: 400 lbf and 11,500 psi.
6. Detectable Line-Warning Tape :
   a. Detectable three-layer laminate, consisting of printed pigmented polyolefin film, solid aluminum-foil core, and clear protective film that allows inspection of continuity of conductive core; bright colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
   b. Width: 3 inch.
   c. Overall Thickness: 5 mil.
   d. Foil Core Thickness: 0.35 mil.
   e. Weight: 28 lb/1000 sq. ft.
   f. Tensile in accordance with ASTM D882: 70 lbf and 4600 psi.
7. Reinforced Detectable Line-Warning Tape :
   a. Reinforced, detectable three-layer laminate, consisting of printed pigmented woven scrim, solid aluminum-foil core, and clear protective film that allows inspection of continuity of conductive core; bright-colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.
   b. Width: 3 inch.
   c. Overall Thickness: 8 mil.
   d. Foil Core Thickness: 0.35 mil.
   e. Weight: 34 lb/1000 sq. ft.
   f. Tensile in accordance with ASTM D882: 300 lbf and 12,500 psi.

2.5 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brady Corporation
      b. Carlton Industries, LP
      c. emedco
      d. Marking Services Inc.
      e. Seton Identification Products; a Brady Corporation company

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brady Corporation
      b. Carlton Industries, LP
      c. emedco
      d. Grafoplast Wire Markers
      e. LEM Products Inc.
      f. Marking Services Inc.
      g. Panduit Corp
      h. Seton Identification Products; a Brady Corporation company

2.6 SIGNS

A. Baked-Enamel Signs:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brady Corporation
      b. Carlton Industries, LP
      c. Champion America
      d. emedco
      e. Marking Services Inc.
   2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   3. 1/4 inch grommets in corners for mounting.
   4. Nominal Size: 7 by 10 inch.

B. Metal-Backed Butyrate Signs:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brady Corporation
      b. Champion America
      c. emedco
      d. Marking Services Inc.
   2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396 inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
   3. 1/4 inch grommets in corners for mounting.
   4. Nominal Size: 10 by 14 inch.

C. Laminated Acrylic or Melamine Plastic Signs:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brady Corporation
      b. Carlton Industries, LP

c. emedco
d. Marking Services Inc.
e. Seton Identification Products; a Brady Corporation company

2. Engraved legend.
3. Thickness:
   a. For signs up to 20 sq. inch, minimum 1/16 inch thick.
   b. For signs larger than 20 sq. inch, 1/8 inch thick.
   c. Engraved legend with black letters on white face.
   d. Punched or drilled for mechanical fasteners with 1/4 inch grommets in corners for mounting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:
   1. Fire-protection and fire-alarm equipment, including raceways, must be finished, painted, or suitably marked safety red.
   2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft above finished floor.

B. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
   1. Color must be factory applied or field applied for sizes larger than 6 AWG when permitted by authorities having jurisdiction.
   2. Colors for 208Y/120 V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   3. Color for Neutral (Grounded Conductor): White.
   4. Color for Equipment Ground: Bare copper or Green.

C. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

D. Locations of Underground Lines: Underground-line warning tape for power and lighting.

E. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
   2. Identify system voltage with black letters on orange field.

F. Cover Plates: Label inside of individual cover plates with self-adhesive labels. Place label at top of cover plate. Label cover plate with the following information, in the order listed:
   1. Panelboard designation.
   2. Colon or dash.
   3. Branch circuit number.

G. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Equipment Identification Labels:
   1. Black letters on white field.
   2. Indoor Equipment: Self-adhesive label.
   3. Outdoor Equipment: Laminated acrylic or melamine sign.
   4. Equipment to Be Labeled:
      a. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of engraved, laminated acrylic or melamine label.
      b. Enclosures and electrical cabinets.
      c. Access doors and panels for concealed electrical items.
      d. Enclosed switches.
      e. Enclosed circuit breakers.
      f. Power-transfer equipment.

3.3 SELECTION OF SIGNS AND HAZARD MARKINGS

A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.

B. Signs, labels, and tags required for personnel safety must comply with the following standards:
   1. Safety Colors: NEMA Z535.1.
   2. Facility Safety Signs: NEMA Z535.2.
   3. Safety Symbols: NEMA Z535.3.
   4. Product Safety Signs and Labels: NEMA Z535.4.
   5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.

C. Electrical Hazard Warnings:
   1. Multiple Power Sources Warning Legend: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. OSHA Workspace Clearance Warning Legend: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."

D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
   1. Apply to exterior of door, cover, or other access.

3.4 INSTALLATION

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

C. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

D. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

E. Install identifying devices before installing acoustical ceilings and similar concealment.

F. Verify identity of item before installing identification products.

G. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

H. Apply identification devices to surfaces that require finish after completing finish work.

I. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.

K. Vinyl Wraparound Labels:
   1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
   2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.

L. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.

M. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.

N. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.

O. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.

P. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

Q. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
   1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

R. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

S. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.

T. Underground Line Warning Tape:
   1. During backfilling of trenches, install continuous underground-line warning tape not less than 12 inch directly above cables or raceways buried 18 inch or more below grade. Use multiple tapes where width of multiple lines installed in common trench or concrete envelope exceeds 16 inch overall.
   2. Install underground-line warning tape for direct-buried cables and cables in raceways.

U. Baked-Enamel Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

V. Metal-Backed Butyrate Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

W. Laminated Acrylic or Melamine Plastic Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Time switches.
   2. Outdoor photoelectric switches.
   3. Occupancy sensors.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
   2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding of lighting control devices referenced by this Section.
   3. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers and supports referenced by this Section.
   4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
   5. Section 262726 "Wiring Devices" for wall-box dimmers and manual light switches.

1.2 DEFINITIONS

A. DPDT: Double pole double throw.

B. DPST: Double pole single throw.

C. N.C.: Normally closed.

D. N.O.: Normally open.

E. PIR: Passive infrared.

F. SPDT: Single pole double throw.

G. SPST: Single pole single throw.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
      a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
      b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
      c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are unacceptable for submitted product.
   2. Include manufacturer's sample extended warranty language.

B. Shop Drawings: Prepare and submit the following:
   1. Show installation details for the following:
      a. Occupancy sensors.
   2. Interconnection diagrams showing field-installed wiring.
   3. Diagrams for power, signal, and control wiring.

C. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements:
1. Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 TIME SWITCHES

A. UL WGZR - Electronic Time Switch:
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. Eaton
   b. Intermatic, Inc
   c. Leviton Manufacturing Co., Inc.
   d. nLight; Acuity Brands Lighting, Inc.
   e. NSi Industries LLC
   f. Schneider Electric USA, Inc.
   g. TE Connectivity Ltd.
   h. Touché Lighting Control
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Clock-Operated Switches: UL CCN WGZR, including UL 917.
4. Standard Features:
   a. Contact Configuration: As indicated on drawings.
   b. Contact Rating: 20 A driver load, 120/240 V(ac).
   c. Automatic daylight savings time changeover.
   d. Battery Backup: Not less than seven days' reserve, to maintain schedules and time clock.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

A. UL WJFX - Solid-State Outdoor Photoelectric Switch, Flexible Mounting:
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. Eaton
   b. Intermatic, Inc
   c. Leviton Manufacturing Co., Inc.
   d. nLight; Acuity Brands Lighting, Inc.
   e. NSi Industries LLC
   f. TE Connectivity Ltd.
2. Source Limitations: Obtain products from single manufacturer.
3. Standard Features:
   a. Solid state, with SPST dry contacts rated for 1800 VA inductive, to operate connected relay, contactor coils, or microprocessor input; and compatible with drivers and LED lamps.
   b. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

c. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
d. Time Delay: Fifteen-second minimum, to prevent false operation.
e. Surge Protection: Metal-oxide varistor.
f. Mounting: Twist lock complies with ANSI C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure from same source and manufacturer as switch.
g. Failure Mode: Luminaire stays ON.

2.4 OCCUPANCY SENSORS

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. HLI Solutions; brand of GE Current, a Daintree Company
2. Lithonia Lighting; Acuity Brands Lighting, Inc.
3. Watt Stopper.
4. Sensor Switch
5. Leviton
6. SensorWorx; brand of BLP Technologies, Inc.

B. Source Limitations: Obtain products from single manufacturer.

C. Dual-Technology, Passive-Infrared (PIR) and Passive-Acoustic Occupancy Sensor:
1. Standard Features:
a. Ceiling-mounted, solid-state indoor occupancy sensors.
b. Integrated and separate power pack and secondary packs as indicated on drawings.
c. Hardwired connection to switch.
d. Sensitivity Adjustment: Separate for each sensing technology.
e. Detector Sensitivity: Detect occurrences of 6 inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch, and detect a person of average size and weight moving not less than 12 inch in either a horizontal or a vertical manner at an approximate speed of 12 inch/s.
2. Operation:
a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

D. Wall-Switch Occupancy Sensor:
1. Standard Features:
a. Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in single gang switchbox using hardwired connection.
1) Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2) Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3) Switch Rating: Not less than 800 VA LED load at 120 V.
b. Sensing Technology: Dual technology - PIR and ultrasonic.
c. Switch Type:
d. Capable of controlling load in three-way application.
e. Voltage: Match circuit voltage.
f. Time Delay:
1) Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
g. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
h. Color: Gray.
i. Faceplate: Stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 INSTALLATION OF LIGHTING CONTROL DEVICES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
   1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
   2. Electrical Maintenance: NFPA 70B.
   3. Electrical Safety: NFPA 70E.
   4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
   5. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:
   1. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
   2. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.
   3. Installation of Wiring:
      a. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's published instructions.
      b. Size conductors in accordance with lighting control device manufacturer's published instructions unless otherwise indicated.
      c. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

D. Interfaces with Other Work:
   1. Identification: Provide labels for lighting control devices and associated electrical equipment.
      a. Identify field-installed conductors, interconnecting wiring, and components.
      b. Label each enclosure with engraved metal or laminated-plastic nameplate.
      c. Identify controlled circuits in lighting contactors.
      d. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
      e. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Nonconforming Work:
1. Lighting control devices will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to the Project site during other-than-normal occupancy hours for this purpose. Some of the Work may be required during hours of darkness.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

END OF SECTION 260923

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Panelboards.
   2. Disconnecting and overcurrent protective devices.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional abbreviations, definitions, submittals, qualifications, testing agencies, and other requirements applicable to the Work for electrical, communications, and electronic safety and security systems on Project, including wiring methods.
   2. Section 260529 "Hangers and Supports for Electrical Systems" specifies concrete bases and supports for panelboards installed by this Section.
   3. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
   4. Section 264313 "Surge Protective Devices for Low-Voltage Electrical Power Circuits" specifies Type 1 and Type 2 surge protective devices installed by this Section.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. VPR: Voltage protection rating.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

B. Shop Drawings: For each panelboard and related equipment:
   1. Include dimensioned plans, elevations, sections, and details.
   2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
   3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   4. Detail bus configuration, current, and voltage ratings.
   5. Short-circuit current rating of panelboards and overcurrent protective devices.
   6. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series rating of installed devices.
   7. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for SPD as installed in panelboard.
   8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   9. Include wiring diagrams for power, signal, and control wiring.

C. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

B. Manufacturer's published instructions.

C. Field Reports:
   1. Manufacturer's field reports for field quality-control support.
   2. Field reports for voltage monitoring and adjusting.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Special tools.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards

B. Handle and prepare panelboards for installation in accordance with NECA 407.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. 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.

C. Comply with NEMA PB 1.

D. Enclosures: Flush and Surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: UL 50E, Type 1.
      b. Outdoor Locations: UL 50E, Type 3R.
   2. Height: 7 ft maximum.
   3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims must cover live parts and may have no exposed hardware.
   4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims must cover live parts and may have no exposed hardware.
   5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
   6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
   7. Finishes:
      a. Panels and Trim: 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.

E. Phase, Neutral, and Ground Buses:
   1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
      a. Plating must run entire length of bus.
      b. Bus must be fully rated for entire length.
   2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
   3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

F. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
   2. Terminations must allow use of 75 deg C rated conductors without derating.

3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with lug on neutral bar for each pole in panelboard.
5. Ground Lugs and Bus-Configured Terminators: [**Compression**][**Mechanical**] type, with lug on bar for each pole in panelboard.

G. Quality-Control Label: Panelboards or load centers must be labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers must have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

H. Future Devices: Panelboards or load centers must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Panelboard Short-Circuit Current Rating:
1. Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by qualified electrical testing laboratory recognized by authorities having jurisdiction. Include label or manual with size and type of allowable upstream and branch devices listed and labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series-connected short-circuit rating.
    a. Panelboards rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
    b. Panelboards rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.

2.2 PANELBOARDS

A. UL QEUY - Distribution Panelboard:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Eaton
    b. Siemens Industry, Inc., Energy Management Division
    c. Square D; Schneider Electric USA
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
    a. Distribution Type Panelboards: UL CCN QEUY; including UL 67 and NEMA PB 1.
4. Standard Features:
    a. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
        1) For doors more than 36 inch high, provide two latches, keyed alike.
    b. Mains: as indicated on drawings.
        1) Location: Convertible between top and bottom.
        2) Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.
    c. Branch Overcurrent Protective: Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
5. Other Available Features Required by Project:
    a. Surge Suppression: Factory installed as integral part of indicated panelboards, complying with UL 1449 SPD Type 2.
    b. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.

B. UL QEUY - Lighting and Appliance Branch-Circuit Panelboard:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Eaton

b. Siemens Industry, Inc., Energy Management Division
c. Square D; Schneider Electric USA

2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Lighting and Appliance Branch-Circuit Type Panelboards: UL CCN QEUY; including UL 67 and NEMA PB 1.
4. Standard Features:
   a. Mains: Circuit breaker or lugs only.
      1) Location: Convertible between top and bottom.
      2) Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.
   b. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
5. Other Available Features Required by Project:
   a. Surge Suppression: Factory installed as integral part of indicated panelboards, complying with UL 1449 SPD Type 2.
   b. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.
   c. Doors: Door-in-door construction with concealed hinges; secured with flush latch with tumbler lock; keyed alike. Outer door must permit full access to panel interior. Inner door must permit access to breaker operating handles and labeling, but current carrying terminals and bus must remain concealed.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton
   2. Siemens Industry, Inc., Energy Management Division
   3. Square D; Schneider Electric USA

B. MCCB: Comply with UL 489, with series-connected rating interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. 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:
      a. RMS sensing.
      b. Field-replaceable rating plug or electronic trip.
      c. Digital display of settings, trip targets, and indicated metering displays.
      d. Multi-button keypad to access programmable functions and monitored data.
      e. Ten-event, trip-history log. Each trip event must be recorded with type, phase, and magnitude of fault that caused trip.
      f. Integral test jack for connection to portable test set or laptop computer.
      g. Field-Adjustable Settings:
         1) Instantaneous trip.
         2) Long- and short-time pickup levels.
         3) Long- and short-time adjustments.
         4) Ground-fault pickup level, time delay, and I squared T 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 double-pole configurations with Class A ground-fault protection (6 mA trip).

6. GFPE Circuit Breakers: Class B ground-fault protection (30 mA trip).
7. MCCB Features and Accessories:
    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. UL listed for reverse connection without restrictive line or load ratings.
    d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
    h. Multipole units enclosed in single housing with single handle.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Provide fuses and spare fuse cabinet.
2. Fused Switch Features and Accessories:
    a. Standard ampere ratings and number of poles.
    b. Mechanical cover interlock with manual interlock override, to prevent opening of cover when switch is in on position. Interlock must prevent switch from being turned on with cover open. Operating handle must have lock-off means with provisions for three padlocks.
    c. Auxiliary Contacts: Two normally open and normally closed contact(s) that operate with switch handle operation.

2.4 MAINTENANCE MATERIAL ITEMS

A. Spare Parts: Furnish to Owner spare parts, for repairing panelboards and related equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
1. Keys: Two spares for each type of panelboard cabinet lock.
2. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards in accordance with.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:
1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NECA 407.
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:
1. Equipment Mounting:

a. Install floor-mounted panelboards on cast-in-place concrete equipment base(s).
b. Attach panelboard to vertical finished or structural surface behind panelboard.
c. Mount surface-mounted panelboards to steel slotted supports 1-1/4 inch in depth. Orient steel slotted supports vertically.

2. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
3. Provide mounting and anchoring devices.
4. Mount top of trim 7.0 ft above finished floor unless otherwise indicated.
5. Mount panelboard cabinet plumb and rigid without distortion of box.
6. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
7. Install overcurrent protective devices and controllers not already factory installed.
   a. Set field-adjustable, circuit-breaker trip ranges.
   b. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.
8. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
9. Install filler plates in unused spaces.
10. Stub four 1 inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in future.
11. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
12. Mount spare fuse cabinet in accessible location.

D. Interfaces with Other Work:
1. 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.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components.

B. Install warning signs.

C. Panelboard Nameplates: Label each panelboard with nameplate.

D. Device Nameplates: Label each branch circuit device in power panelboards with nameplate.

E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.

F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.

G. Circuit Directory:
1. Provide directory card inside panelboard door, mounted in transparent card holder.
   a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
2. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
   a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
3. Create directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Do not perform optional tests. 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.

B. Nonconforming Work:
   1. Panelboards will be considered defective if they do not pass tests and inspections.
   2. Remove and replace defective units and retest.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.
   1. Include certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Manufacturer Services: Engage factory-authorized service representative to support field tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
   1. Measure loads during period of normal facility operations.
   2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
   3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
   4. Tolerance: Maximum difference between phase loads, within panelboard, may not exceed 20 percent.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General-use switches, dimmer switches, and fan-speed controller switches.
   2. General-grade duplex straight-blade receptacles.
   3. Receptacles with arc-fault and ground-fault protective devices.
   4. Special-purpose power outlet assemblies.
   5. Connectors, cords, and plugs.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
   2. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
   3. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
   4. Section 260923 "Lighting Control Devices" for occupancy sensors, timers, control-voltage switches, and control-voltage dimmers.

1.2 DEFINITIONS

A. AFCI: Arc-Fault Circuit Interrupter.

B. GFCI: Ground-Fault Circuit Interrupter.

C. UL 1472 Type I Dimmer: Dimmer in which air-gap switch is used to energize preset lighting levels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
      a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
      b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
      c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are not acceptable for submitted product.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Special tools.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 GENERAL-USE SWITCHES AND DIMMER SWITCHES

A. Toggle Switch:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eaton, Wiring Devices; Arrow Hart
   b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour; Legrand North America, LLC
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: UL CCN WMUZ and UL 20.
4. Standard Features:
   a. Device Color: White.
   b. Provide rocker type for general duty, toggle type where keyed operation is required.
   c. Configuration:
      1) General-duty, 120-277 V, 20 A, single pole, and three way.
         a) Provide with forked key lock where indicated.

B. Type I Dimmer Switch:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eaton, Wiring Devices; Arrow Hart
   b.
   c. Current HLI
   d.
   e. Leviton Manufacturing Co., Inc.
   f.
   g. Pass & Seymour; Legrand North America, LLC
   h. Sensorworx
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: UL CCN EOYX and UL 1472.
4. Standard Features:
   a. UL 1472 Type I dimmer.
   b. Device Color: White.
   c. Switch Style: Push button.
   d. Dimming Control Style: Slide.

2.3 GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

A. Single Straight-Blade Receptacle:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eaton, Wiring Devices; Arrow Hart
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC
   d. <**Insert manufacturer's name**>
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
3. Standard Features:
   a. Device Color: Black.
   b. Configuration:
      1) General-duty, NEMA 14-50R (Range).
4. Accessories:
   a. Cover Plate: stainless steel.

b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.4 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

A. Duplex Straight-Blade 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. Eaton, Wiring Devices; Arrow Hart
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC
   d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
3. Standard Features:
   a. Device Color: White.
   b. Configuration:
      1) General-duty, smooth face, NEMA 5-20R.

2.5 RECEPTACLES WITH GROUND-FAULT PROTECTIVE DEVICES

A. General-Grade, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eaton, Wiring Devices; Arrow Hart
   b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour; Legrand North America, LLC
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Receptacle GFCIs: UL CCN KCXS, UL 498, and UL 943.
3. Standard Features:
   a. Device Color: White.
   b. Configuration: Heavy-duty, NEMA 5-20R.

B. General-Grade, Weather-Resistant, Tamper-Resistant, Duplex Straight-Blade Receptacle with GFCI Device:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eaton, Wiring Devices; Arrow Hart
   b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour; Legrand North America, LLC
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
   a. Receptacle GFCIs: UL CCN KCXS, UL 498, and UL 943.
3. Standard Features:
   a. Device Color: White.
   b. Configuration: Heavy-duty, NEMA 5-20R.
4. Accessories:
   a. In-use cover:

1) Type: Extra-duty, weather-while-in-use (bubble type) cover with gasketed perimeter and hinged cover.
2) Configuration: Compatible with duplex, Decora (rectangular), and GFCI receptacles as indicated on drawings.
3) Material: UV-resistant, impact-resistant polycarbonate or die-cast aluminum with clear or opaque hinged cover.
4) Listings: UL 514D/514C listed, evaluated to UL 50E for enclosures in wet locations.
5) Compliance: NEC 406.9(B)(1) requirements for receptacles in wet locations (extra-duty type).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.
      c. Receptacles: 18 inches above finished floor or 6 inches above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains flush in wall adjacent to, or below, housing of drinking fountain.

B. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

C. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

D. Install wiring devices plumb and level with mounting yoke held rigidly in place.

E. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized coverplates in lieu of meeting this requirement.

F. Install blank wall plates on junction boxes and on outlet boxes with no wiring device installed or where designated for future use.

G. Identify each wiring device per Section 260553.

3.2 INSTALLATION OF SWITCHES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
   1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
   2. Electrical Safety: NFPA 70E.
   3. Life Safety and Means of Egress Work: NFPA 101.
   4. Wiring Devices: NECA NEIS 130.
   5. Mounting Heights: NECA NEIS 1.
   6. Install with OFF position down.

7. Consult Architect for resolution of conflicting requirements.

C. Interfaces with Other Work:
1. Identification:
a. Identify cover or cover plate for device with panelboard identification and circuit number.

3.3 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
4. Installing and Maintaining Wiring Devices: NECA NEIS 130.
5. Mounting Heights: Unless otherwise indicated in the Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
6. Receptacle Orientation: Unless otherwise indicated in the Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6. Where installed horizontally, locate grounding terminal on left.
7. Where split-wired receptacles are indicated, remove tabs connection top and bottom receptacles.
8. Where GFCI receptacles are indicated, utilize GFCI receptacles at each location. Do not use feed-through wiring to protect downstream devices.
9. Consult Architect for resolution of conflicting requirements.

3.4 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch to verify proper operation.

C. Test each receptacle for proper operation and polarity.

D. Test each GFCI device for proper tripping according to manufacturer’s directions.

E. Correct deficiencies and replace damaged or defective devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust coverplate screws to be uniformly perpendicular to the axis of the device.

C. Adjust presets for wall dimmers according to manufacturer’s instructions as directed by Architect.

3.6 PROTECTION

A. Devices:
1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 262726

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nonfusible switches.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
   2. Enclosure types and details for types other than UL 50E, Type 1.
   3. Current and voltage ratings.
   4. Include evidence of qualified electrical testing laboratory listing for series rating of installed devices.
   5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include wiring diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain products from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB Electrification Installations Products
   2. Eaton
   3. Siemens Industry, Inc., Energy Management Division
   4. Square D; Schneider Electric USA

B. Type GD, General Duty, Three Pole, Single Throw, 240 V(ac), 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. 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. Lugs: Mechanical type, suitable for number, size, and conductor material.

PART 3 - EXECUTION

3.1 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.
   1. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

3.2 SELECTION OF ENCLOSURES

A. Indoor, Dry and Clean Locations: UL 50E, Type 1.

B. Outdoor Locations: UL 50E, Type 3R.

3.3 INSTALLATION

A. Comply with manufacturer's published instructions.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553 "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.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections for Switches:
   1. Visual and Mechanical Inspection:
      a. Inspect physical and mechanical condition.
      b. Inspect anchorage, alignment, grounding, and clearances.
      c. Verify that unit is clean.
      d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
      e. Inspect bolted electrical connections for high resistance using one of the following methods:
         1) Use low-resistance ohmmeter.
            a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
         2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
            a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

B. Nonconforming Work:
   1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
   2. Remove and replace defective units and retest.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.7 PROTECTION

A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 262816

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SECTION 264313 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Type 2 surge protective devices (SPDs).

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
   2. Section 262416 "Panelboards" for integral SPDs installed by panelboard manufacturer.

1.2 DEFINITIONS

A. In: Nominal discharge current.

B. Maximum Continuous Operating Voltage (MCOV): The maximum designated RMS value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.

C. Metal-Oxide Varistor (MOV): An electronic component with a significant bidirectional, nonlinear current-voltage characteristic.

D. Mode(s), Modes of Protection, or Protection Modes: Electrical paths where the SPD offers defense against transient overvoltages. Examples include: line to neutral (L-N), line to ground (L-G), line to line (L-L), and neutral to ground (N-G).

E. SCCR: Short-circuit current rating.

F. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

G. Voltage Protection Rating (VPR): A rating selected from UL 1449 list of preferred values assigned to each mode of protection.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. For each type of product.
      a. Include electrical characteristics, specialties, and accessories for SPDs.
      b. Certification of compliance with UL 1449 by qualified electrical testing laboratory recognized by authorities having jurisdiction including the following information:
         1) Tested values for VPRs.
         2) In ratings.
         3) MCOV, type designations.
         4) OCPD requirements.
         5) Manufacturer's model number.
         6) System voltage.
         7) Modes of protection.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton

2. Schneider Electric USA, Inc.
3. Siemens Industry, Inc., Energy Management Division

B. Source Limitations: Obtain devices from the same manufacturer as Panelboards.

C. General Characteristics:
1. Reference Standards: UL 1449, Type 2; UL 1283.
2. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems.
3. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less values indicated below. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
   a. For distribution panelboards: 160 kA per phase
   b. For branch panelboards: 120 kA per phase
4. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits must not exceed the following:
   a. Line to Neutral: 700 V for 208Y/120 V.
   b. Line to Ground: 700 V for 208Y/120 V.
   c. Neutral to Ground: 700 V for 208Y/120 V.
   d. Line to Line: 1200 V for 208Y/120 V.
5. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits must not exceed the following:
   a. Line to Neutral: 700 V.
   b. Line to Ground: 700 V.
   c. Neutral to Ground: 700 V.
   d. Line to Line: 1200 V.
6. SCCR: Equal or exceed 200 kA.
7. In Rating: 20 kA.

D. Options:
1. Include LED indicator lights for power and protection status.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V(ac) for remote monitoring of protection status.
4. Include surge counter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. SPDs shall be factory installed within panelboards.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's installation requirements.

B. Nonconforming Work:
1. SPDs that do not pass tests and inspections will be considered defective.
2. Remove and replace defective units and retest.

C. Prepare test and inspection reports.

D. Manufacturer Services:
1. Engage factory-authorized service representative to support field tests and inspections.

3.3 STARTUP SERVICE

A. Complete startup checks in accordance with manufacturer's instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION 264313

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SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Luminaires.
   2. Luminaire fittings.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
   2. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" specifies wiring connections installed by this Section.
   3. Section 260529 "Hangers and Supports for Electrical Systems" specifies channel and angle supports installed by this Section.
   4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
   5. Section 260923 "Lighting Control Devices" specifies automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors installed by this Section.

1.2 DEFINITIONS

A. BUG Rating: Backlight, uplight, and glare rating for light pollution from exterior luminaires.

B. Correlated Color Temperature (CCT): The absolute temperature (in kelvins) of a blackbody whose chromaticity (color quality) most nearly resembles that of the light source.

C. Color Rendering Index (CRI): The measure of the degree of color shift objects undergo when illuminated by the light source as compared with the color of those same objects when illuminated by a reference light source. The lower the CRI of a light source, the more difficult it is to identify colors and stripes on electronic components and wiring.

D. IDA: International Dark-Sky Association.

E. IES: Illuminating Engineering Society.

F. LPD: Lighting power density.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Luminaires: Include the following additional information:
      a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
         1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
         2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
         3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.
      b. Product Certificates: Include product certificates stating compliance with standards listed below, signed by manufacturer or fabricator.
         1) Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with current accreditation under National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

2) Testing Agency Certified Data: For luminaires indicated on Lighting Fixture Schedule on the Drawings, photometric data certified by qualified independent testing laboratory. Photometric data for remaining luminaires must be certified by manufacturer.

c. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

d. Include operating characteristics, electrical characteristics, and furnished accessories.

e. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on the Drawings.

f. Include battery and charger data for emergency lighting units.

g. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.

h. Include photometric data and adjustment factors obtained from qualified laboratory tests.

i. Include manufacturer's sample warranty language.

2. Luminaire Fittings: Include the following additional information:

a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.

2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.

3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

c. Include operating characteristics, electrical characteristics, and furnished accessories.

d. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on the Drawings.

e. Include manufacturer's sample warranty language.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' published instructions.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 QUALIFICATIONS

A. Luminaire Photometric Testing Laboratory: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" accredited under NIST HB 150-1, and complying with applicable IES testing standards.

B. Lighting Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with testing and inspecting lighting installations in accordance with applicable IES standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect exposed surface finishes on lighting equipment by applying strippable, temporary protective covering before shipping.

1.8 WARRANTY FOR LUMINAIRES

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed luminaires perform in accordance with specified requirements and agrees to repair or replace products that fail to perform as specified within extended-warranty period. Warranty must convey to Owner upon acceptance of the Work.

1. Extended-Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.

1.9 WARRANTY FOR BATTERIES

A. Special Manufacturer Extended Warranty for Batteries: Manufacturer warrants that batteries perform in accordance with specified requirements and agrees to provide repair or replacement of batteries that fail to perform as specified within extended-warranty period.
   1. Initial Extended-Warranty Period for Li-ion Batteries: Five years from date of Substantial Completion; full coverage for materials only, freight prepaid.
   2. Initial Extended-Warranty Period for Ni-Cd Batteries: Five years from date of Substantial Completion; full coverage for materials only, freight prepaid.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 LUMINAIRES

A. Light Fixture Schedule contains basis of design. Provide fixtures as scheduled or submit substitute equivalent fixtures from alternate manufacturers for review a minimum of ten days prior to bid date.
   1. Source Limitations: Obtain products for similar luminaire types from single manufacturer.
   2. Listing Criteria:
      a. LED Luminaires: UL CCN IFAM; including UL 1598.
      b. Outdoor Canopy Luminaires: UL CCN IFAW; including UL 1598.
      c. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.

B. UL FTBR or FTBV - Emergency Lighting and Power Equipment:
   1. Source Limitations: Obtain products from single manufacturer.
   2. Listing Criteria:
      a. Emergency Lighting and Power: UL CCN FTBR or UL CCN FTBV; including UL 924, NFPA 101, and ICC IBC.
      b. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.
   3. Standard Features:
      a. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
      b. Status and Test Indication: Visible and accessible without opening luminaire or entering ceiling space.
         1) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
         2) Test Push-Button: Push-to-test button in unit housing simulates loss of normal power and demonstrates unit operability.
      c. Nominal Operating Voltage: 120 V(ac).
      d. Mounting: Ceiling or Wall with universal junction box adaptor.
      e. Enclosure: UV stable thermoplastic housing.
      f. Light Source: Two LED head(s).
   4. Other Available Features Required by the Project:
      a. Mounting Height: As indicated on drawings.

C. UL FWBO - Exit Fixture:
   1. Source Limitations: Obtain products from single manufacturer.
   2. Listing Criteria:

a. Exit Fixtures: UL CCN FWBO; including UL 924, NFPA 101[**, NFPA 5000**], and ICC IBC.
b. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.

3. Standard Features:
a. Nominal Operating Voltage: 120 V(ac).
b. Light Source: LED; 50,000 hours minimum rated life.
c. Internal emergency power unit.
d. Master/Remote Sign Configurations:
1) Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
2) Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

4. Other Available Features Required by the Project:
a. Mounting Height: As indicated on drawings.

2.3 LUMINAIRE FITTINGS

A. Luminaire Support Accessories:
1. Standard Features:
a. Sized and rated for luminaire weight.
b. Capable of maintaining luminaire position after cleaning and relamping.
c. Capable of supporting luminaire without causing deflection of ceiling or wall.
d. Capable of supporting horizontal force equal to 100 percent of luminaire weight and vertical force equal to 400 percent of luminaire weight.
2. Other Available Features Required by the Project:
a. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage wire supports adjustable to 10 ft in length.
b. Aircraft Cables: 5/32 inch diameter aircraft cable supports adjustable to 10 ft in length.

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. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LIGHTING

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
3. Work in Confined Spaces: NFPA 350.
4. Installation of Indoor Lighting Systems: NECA NEIS 500.
5. Installation of Exterior Lighting Systems: NECA NEIS 501.
6. Installation of Luminaires, Lampholders, and Lamps: Article 410 of NFPA 70.
7. Installation of Emergency Lighting and Exit Signs: ICC IBC, NFPA 101, and Parts IV and V in Article 700 of NFPA 70.

8. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:
1. Install luminaires level, plumb, and square with finished floor or grade unless otherwise indicated.
2. Install luminaires at height and aiming angle as indicated on the Drawings.
3. Coordinate layout and installation of luminaires with other construction.
4. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
5. Exterior Corrosion Prevention:
   a. Do not use aluminum in contact with earth or concrete. When in direct contact with dissimilar metals, protect aluminum with insulating fittings or treatment.
   b. When embedding steel conduits in concrete, wrap conduit with 10 mil thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
6. Flush-Mounted Luminaire Support:
   a. Secured to outlet box.
   b. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
   c. Trim ring flush with finished surface.
7. Wall-Mounted Luminaire Support: Attached to structural members in walls.
   a. Do not attach luminaires directly to gypsum board.
8. Suspended Luminaire Support:
   a. Ceiling Mount:
      1) Two aircraft cables.
   b. Continuous Rows of Luminaires: Provide tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
9. Ceiling-Grid-Mounted Luminaire Support:
   a. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inch from luminaire corners.
   b. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for application.
   c. Luminaires of Sizes Smaller than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with no fewer than two 3/4 inch metal channels spanning and secured to ceiling tees.
10. Remote Mounting of Ballasts or Drivers: Do not exceed distance between ballast or driver and luminaire recommended by ballast or driver manufacturer.
11. Emergency Power Units: Secure with approved fasteners in four or more locations, spaced near corners of unit.
12. Install wiring connections for luminaires.
13. Identification: Provide labels for luminaires and associated electrical equipment.
   a. Identify field-installed conductors, interconnecting wiring, and components.
   b. Provide warning signs.
   c. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL OF LIGHTING

A. Tests and Inspections:
1. Perform manufacturer's recommended tests and inspections.
2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
3. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
4. Verify operation of photoelectric controls.

B. Nonconforming Work:
1. Luminaire will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

3.4 PROTECTION

A. After installation, protect lighting equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 265000

SECTION 284600 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Dedicated function control units.
2. Fire-alarm remote annunciators.
3. Heat-sensing fire detectors.
4. Smoke-sensing fire detectors.
5. Sprinkler waterflow alarm-initiating devices.
6. Combination audible/visual notification appliances.
7. Fire-alarm supervised control module interfaces for fire safety functions.
8. Fire-alarm cables.

B. Related Requirements:
1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
2. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers, supports, and concrete bases referenced by this Section.
3. Section 260533.13 "Conduits for Electrical Systems" specifies raceway types installed by this Section.
4. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:
1. AWG: American wire gauge; see ASTM B258.
2. cd: Candela, the SI fundamental unit of luminous intensity.
3. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
4. EPS: Emergency power supply.
5. EPSS: Emergency power supply system.
6. ERCES: Emergency responder communications enhancement system.
7. FACU: Fire-alarm control unit.
8. FAS: Fire-alarm system.
9. IDC: Initiating device circuit.
10. IR: Infrared.
11. LCD: Liquid-crystal display.
12. LED: Light-emitting diode.
13. Li-ion: Lithium-ion.
14. NAC: Notification appliance circuit.
15. N.C.: Normally closed.
16. Ni-Cd: Nickel-cadmium.
17. Ni-MH: Nickel-metal hydride.
18. N.O.: Normally open.
19. PLFA: Power-limited fire alarm.
20. SLC: Signaling-line circuit.
21. TR: Tamper resistant.
22. UL: (standards) UL Standards & Engagement Inc.; (product categories) UL Solutions, Inc.
23. UL CCN: UL Category Control Number.
24. UPS: Uninterruptible power supply.
25. VRLA: Valve regulated lead acid; also called "sealed lead acid (SLA)" or "valve regulated sealed lead acid."
26. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:
   1. FPLP: Power-limited fire-alarm plenum cable.

C. Definitions:
   1. Cable: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "cable" is (1) a conductor with insulation, or a stranded conductor with or without insulation (single-conductor cable); or (2) a combination of conductors insulated from one another (multiple-conductor cable).
   2. Conductor: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "conductor" is (1) a wire or combination of wires not insulated from one another, suitable for carrying an electric current; (2) (National Electrical Safety Code) a material, usually in the form of wire, cable, or bar, suitable for carrying an electric current; or (3) (general) a substance or body that allows a current of electricity to pass continuously along it.
   3. Conduit: A structure containing one or more duct raceways.
   4. Duct Raceway: A single enclosed raceway for conductors or cable.
   5. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
   6. Wire: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "wire" is a slender rod or filament of drawn metal. A group of small wires used as a single wire is properly called a "stranded wire." A wire or stranded wire covered with insulation is properly called an "insulated wire" or a "single-conductor cable." Nevertheless, when the context indicates that the wire is insulated, the term "wire" will be understood to include the insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. In addition to information identified in Section 013300 "Submittal Procedures," submit the following:
   1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
      a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
      b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
      c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are not acceptable for submitted product.

B. Shop Drawings: Prepare and submit the following:
   1. Cover sheet indicating protected premises name and location and Owner information, name of installer, device legend and symbols, and date of issue and any revision dates.
   2. Floor Plans:
      a. Floor or level identification.
      b. Point of compass (indication of north).
      c. Graphic scale.
      d. All walls and doors.
      e. All partitions extending to within 15 percent of the ceiling height.
      f. Room and area descriptions.
      g. System devices/component locations.
      h. Locations of the system's primary power disconnecting means.
      i. Locations of monitor/control interfaces to other systems.
      j. System riser locations.

k. Type and number of system components/devices on each circuit, on each floor or level.
l. Type and quantity of conductors[**and conduit**] for each circuit.

3. Wiring Diagrams:
   a. System riser diagrams coordinated with the floor plans and indicating the following information:
      1) General arrangement of the system in building cross-section.
      2) Number of risers.
      3) Type and number of circuits in each riser.
      4) Type and number of system components/devices on each circuit, on each floor or level.
      5) Number of conductors for each circuit.
   b. Control unit diagrams for all control equipment, power supplies, battery chargers, and annunciators indicating the following information:
      1) Identification of control equipment depicted.
      2) Location(s) of control equipment.
      3) All field wiring terminals and terminal identifications.
      4) All circuits connected to field wiring terminals and circuit identifications.
      5) All indicators and manual controls.
      6) Field connections to supervising station signaling equipment, releasing equipment, and emergency safety control interfaces.
   c. Typical fire-alarm component schematic wiring diagrams for all initiating devices, notification appliances, and annunciators.
4. Fire-Alarm Input/Output Sequence: Include a narrative description or input/output matrix of operation to describe the fire-alarm system sequence of operation.
5. Calculations:
   a. Battery calculations.
   b. Voltage-drop calculations.

C. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

B. Field Reports:
1. Manufacturer's field reports for field quality-control support.
2. Manufacturer's field reports for system startup support.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

B. Maintenance service agreement.

C. Software and firmware service agreement.

1.6 REGULATORY AGENCY APPROVALS

A. Submittals for fire detection and alarm system requiring approval by authorities having jurisdiction must be signed by qualified NICET FAS Level III engineering technician or life-safety professional engineer responsible for their preparation. Obtain approval by authorities having jurisdiction prior to submitting for action by Architect.

1.7 QUALIFICATIONS

A. Fire-Alarm Systems (FAS) Technician Trainee: Having at least six months of experience and possessing active NICET FAS Level I certification. Able to perform limited tasks under direct supervision.

B. Fire-Alarm Systems (FAS) Associate Engineering Technician: Having at least two years of experience and possessing active NICET FAS Level II certification. Able to review drawings, specifications, codes, and standards; to conduct basic installation activities; and to perform basic troubleshooting.

C. Fire-Alarm Systems (FAS) Engineering Technician: Having at least five years of experience and possessing active NICET FAS Level III certification. Able to perform system layout activities, supervise Level I and Level II technicians, provide submittal packages, and interact with authorities having jurisdiction.

D. Fire-Alarm Systems (FAS) Senior Engineering Technician: Having at least 10 years of experience and possessing active NICET FAS Level IV certification. Able to manage multiple projects at once, interpret codes and standards, conduct training, and serve as liaison between authorities having jurisdiction, owners, engineers, and contractors.

E. Inspection and Testing of Fire-Alarm Systems (I&TFAS) Technician I: Possessing active NICET I&TFAS Level I certification. Able to perform periodic inspections and tests of basic fire-alarm systems and prepare related records and reports.

F. Inspection and Testing of Fire-Alarm Systems (I&TFAS) Technician II: Possessing active NICET I&TFAS Level II certification. Able to plan, perform, and coordinate periodic inspections and tests of complex fire-alarm systems (including one or more of suppression interfaces, networked control units, smoke control interfaces, air sampling systems, multi-zone voice evacuation systems, or high-rise applications) and prepare related records and reports.

G. Fire-Alarm Testing Agency: Entity possessing active credentials from qualified electrical testing laboratory recognized by authorities having jurisdiction.
   1. On-site fire-alarm testing supervisor must possess active NICET I&TFAS Technician I certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70 or NFPA 72, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. System Description: Noncoded, UL-certified system with multiplexed signal transmission and horn-and-strobe notification for evacuation.

C. System Inputs:
   1. Fire-alarm signal initiation must be by one or more of the following devices :
      a. Heat detectors.
      b. Smoke detectors.
      c. Automatic sprinkler system water flow.
   2. Supervisory signal initiation must be by one or more of the following devices and actions:
      a. Valve supervisory switch.
      b. Elevator shunt-trip control circuit supervision.
      c. Zones or individual devices have been disabled.
   3. System trouble signal initiation must be by one or more of the following devices and actions:
      a. Open circuits, shorts, and grounds in designated circuits.
      b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
      c. Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, or ethernet module.
      d. Loss of primary power at FACU.
      e. Ground or single break in internal circuits of FACU.
      f. Abnormal AC voltage at FACU.
      g. Break in standby battery circuitry.
      h. Failure of battery charging.

D. System Outputs:
   1. Fire-alarm signal must initiate the following actions:

a. Identify alarm and specific initiating device at FACU and remote annunciators.
b. Recall elevators to designated or alternate recall levels only upon activation of smoke detectors in respective elevator lobbies, machine rooms, or hoistways.
c. Activate elevator power shunt trip only upon activation of associated heat detector.
d. Record events in system memory.
e. Indicate device in alarm on graphic annunciator.

2. System supervisory signal must initiate the following actions:
a. Initiate supervisory notification appliances.
b. Identify specific device initiating event at FACU and remote annunciators.
c. Display system status on graphic annunciator.

2.2 DEDICATED FUNCTION CONTROL UNITS

A. Description: A protected premises fire-alarm control unit specifically listed for supervising a single function, such as releasing service that is part of a fire-suppression system and which provides control outputs to release a fire-suppression agent based on either automatic or manual input.

B. UL UOJZ - Addressable Non-Extinguishing and Non-Water-Based Releasing Device Control Unit:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a.
b. Silent Knight; Honeywell International, Inc.
c. Notifier; Honeywell International, Inc.
2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. Releasing Device Control Units for Fire-Protective Signaling Systems: UL CCN UOJZ, including UL 864 and NFPA 72.
4. Standard Features:
a. Product Reference Standards: Ch. 23 of NFPA 72.
b. Built-in alarm, trouble, supervisory, and security relays.
c. Minimum of two Class A signaling-line circuits.
d. Auto programming and walk test reports.
e. Manual sensitivity adjustments.
f. Maintenance alerts.
g. Battery charger supports.
h. Non-alarm points for lower-priority functions.

2.3 FIRE-ALARM REMOTE ANNUNCIATORS

A. Description: A unit containing one or more indicator lamps, alphanumeric displays, or other equivalent means in which each indication provides status information about a fire-alarm system device, circuit, condition, or location.

B. UL UOXX - Fire-Alarm System Remote Annunciators:
1. Source Limitations: Obtain products from same manufacturer as control unit.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. Control Unit Accessories for Fire-Protective Signaling Systems: UL CCN UOXX, including UL 864 and NFPA 72.
3. Standard Features:
a. Product Reference Standards: Ch. 23 of NFPA 72.
b. Compatibility with fire-alarm control unit for alphanumeric display and LED indicating lights.
c. Provide controls to acknowledge, silence, reset and test functions for alarm, supervisory, and trouble signals.

2.4 HEAT-SENSING FIRE DETECTORS

A. UL GPAX - Fixed-Temperature Heat Detectors:
   1. Source Limitations: Obtain products from same manufacturer as control units.
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Heat-Detecting-Type Automatic Fire Detectors: UL CCN GPAX, including UL 521 and NFPA 72.
   3. Standard Features:
      a. Product Reference Standards: Ch. 17 of NFPA 72.
      b. Actuated by temperature that exceeds fixed temperature of 135 deg F regardless of rate of temperature rise.
      c. [**Conventional**][**Addressable**]-type initiating device.
      d. Detector must have functional humidity range of 10 to 90 percent.

2.5 SMOKE-SENSING FIRE DETECTORS

A. Description: A device that detects visible or invisible particles of combustion and initiates an action. Types of smoke-sensing fire detectors include spot-type detectors, air-sampling detectors, projected beam-type detectors, duct detectors, multi-criteria detectors, and video image smoke detectors.

B. UL GUOX - Spot-Type Smoke Detectors:
   1. Source Limitations: Obtain products from same manufacturer as control units.
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Detectors Designed for Smoke Particles: UL CCN GUOX, including UL 268 and NFPA 72.
   3. Standard Features:
      a. Product Reference Standards: Ch. 17 of NFPA 72.
      b. Field programmable.
      c. Resettable from the control unit.
      d. Removable from the base assembly without the use of tools and without disturbing the wiring connections.
      e. Sensing Type: Photoelectric.

2.6 SPRINKLER WATERFLOW ALARM-INITIATING DEVICES

A. Description: An initiating device used to monitor the flow of water in a wet-pipe or dry-pipe sprinkler system for the purpose of initiating an alarm signal. These devices employ operating mechanisms that include paddle operation, pressure operation, or mechanical operation.

B. UL VLFT - Sprinkler Waterflow Alarm-Initiating Device :
   1. Source Limitations: Obtain products from same manufacturer as control units.
   2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
      a. Extinguishing System Attachments: UL CCN VLFT, including UL 346 and NFPA 72.
   3. Standard Features:
      a. Product Reference Standards: Ch. 17 of NFPA 72.
      b. Activation of the initiating device occurs within 90 seconds of waterflow at the alarm-initiating device when flow occurs that is equal to or greater than that from a single sprinkler of the smallest orifice size installed in the system.
      c. Movement of water due to waste, surges, or variable pressure must not initiate an alarm signal.
      d. Adjustable time delay.
      e. Pressure Range: 20 to 175 psig.

f. Operating Type: Paddle, Pressure, or Mechanically operated.
g. Non-coded signaling contacts.

2.7 COMBINATION AUDIBLE/VISUAL NOTIFICATION APPLIANCES

A. Description: A fire-alarm system component such as a horn/strobe or loudspeaker/strobe that provides both an audible and a visible output to alert occupants by the sense of hearing and sight.

B. UL DHZX - Combination Horn/Strobe Appliances:
1. Source Limitations: Obtain products from same manufacturer as control units.
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
a. Electrically Operated Signal-Sounding Appliances or Visual-Signal Appliances for Fire-Protective Signaling Applications: UL CCN DHZX, including UL 464, UL 1638, and NFPA 72.
3. Standard Features:
a. Product Reference Standards: Ch. 18 of NFPA 72.
b. Operating Temperature Range: 32 deg F to 120 deg F.
c. Compatible with wires up to 12 AWG.
d. Rated Light Output: 75 candela.
e. Clear or nominal white polycarbonate lens mounted on faceplate.
f. Strobe flash rate of 1 Hz over its entire operating range.
g. Operates on a coded or non-coded power supply.
h. Field-selectable candela settings.
i. Field-selectable volume settings.
j. Universal mounting plate for ceiling units.
4. Other Available Features Required by Project:
a. For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
b. Weather resistant to provide protection against water, humidity, and corrosion.

2.8 FIRE-ALARM CABLES

A. UL HNKTX - Non-Power-Limited Fire-Alarm Circuit Plenum Cable:
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. Prysmian Cables and Systems; Prysmian Group North America
b. Southwire Company, LLC
c. West Penn Wire; brand of Belden, Inc.
2. Listing Criteria:
a. Non-Power-Limited Fire-Alarm Cable: UL CCN HNKTX; including UL 1425 and Article 760 of NFPA 70.
b. Vertical-Tray Flame Test: UL 1685.
c. Limited Smoke "ST1" Marking: UL 1685 or UL 2556.
d. Plenum Rating: NFPA 262.
3. Standard Features:
a. Solid copper conductors with 600 V rated, 75 deg C, color-coded insulation.
b. Minimum Conductor Size: 18 AWG.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine field conditions with Installer present for compliance with requirements for fire detection and alarm systems and other conditions affecting performance of the Work.

B. Examine all materials, products, and equipment received for defects or damage.

C. Reject all materials, products, and equipment that show signs of defects or damage.

D. Examine roughing-in for fire detection and alarm system piping to verify actual locations of piping connections before equipment installation.

E. Examine walls, floors, ceilings, and roofs for suitable conditions where fire detection and alarm system components will be installed.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FIRE DETECTION AND ALARM SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:
1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Commissioning of Electrical Systems: NECA NEIS 90.
3. Commissioning of Active and Passive Fire Protection Features: NFPA 3 and NFPA 4.
4. Fire-Alarm Circuits and Pathways: Ch. 12 of NFPA 72 and Article 760 of NFPA 70.
5. Fire-Alarm Initiating Devices: Ch. 17 of NFPA 72.
6. Fire-Alarm Notification Appliances: Ch. 18 of NFPA 72.
7. Fire-Alarm Control Equipment: Ch. 23 of NFPA 72.
8. Consult Architect for resolution of conflicting requirements.

C. Interfaces with Other Work:
1. Identification: Provide labels for all initiating devices, control equipment cabinets, and associated electrical equipment.
    a. Identify field-installed conductors, interconnecting wiring, and components.
    b. Label initiating devices with unique identification.
    c. Identify source of AC power inside each control equipment cabinet.
    d. Identify circuit disconnecting means at AC power source with red engraved label. Provide approved locking device for circuit disconnecting means.
    e. Label enclosures with engraved metal or laminated-plastic nameplate.
    f. Identify junction box covers using the color red.
    g. Identify conduit using the color red.
2. Coordinate with Division 21 for Fire Sprinkler Systems.

3.3 FIELD QUALITY CONTROL OF FIRE DETECTION AND ALARM SYSTEMS

A. Tests and Inspections:
1. Perform manufacturer's recommended tests and inspections.
2. Perform system acceptance testing in accordance with Ch. 14 of NFPA 72.
3. Contractor is responsible for completing pre-acceptance testing to verify proper operation of the fire detection and alarm systems. Correct system deficiencies prior to scheduling a final acceptance test.

B. Nonconforming Work:
1. Initiating devices, notification appliances, control equipment, and system accessories will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

D. Manufacturer Services: Engage factory-authorized service representative to support field tests and inspections.
1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.4 SYSTEM STARTUP

A. Perform startup service.
   1. Complete installation and startup checks in accordance with manufacturer's published instructions.
   2. Provide power to the FACU and configure internal settings.
   3. Test all field wiring prior to connecting field devices and prior to connecting to the FACU. Ensure field wiring is free from ground faults and short circuits.
   4. Connect field devices to field wiring.
   5. Connect field wiring inside FACU cabinet.
   6. Ensure system is normal and free from ground faults, open circuits, or short circuits.

B. Manufacturer Services: Engage factory-authorized service representative to support system startup.
   1. Manufacturer's Field Reports for System Startup Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.5 PROTECTION

A. After installation, protect fire detection and alarm system equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 284600

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