PROJECT MANUAL

for

CITY OF WARREN

DOROTHY M. BUSCH LIBRARY

ITB-W-9330

James R. Fouts, Mayor

One City Square
Warren, MI 48093-5289

ARCHITECT:
PARTNERS in Architecture, PLC
65 Market Street, Suite 200
Mount Clemens, MI 48043
Phone 586.469.3600 Fax 586.469.3607

PARTNERS PROJECT # 15-142
JANUARY 13, 2016 / BIDDING – CONSTRUCTION

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PROJECT IDENTIFICATION

PROJECT: **DOROTHY M. BUSCH LIBRARY**
23333 Ryan Road
Warren, MI 48091

OWNER: CITY OF WARREN
One City Square
Warren, MI 48093

CITY OF WARREN PROJECT NUMBER: ITB-W-9330

ARCHITECT: PARTNERS IN ARCHITECTURE, PLC
65 Market Street
Mount Clemens, MI 48043
(586) 469.3600

PARTNERS PROJECT NUMBER: 15-142

BID DUE DATE: **February 10, 2016 @ 12:30PM**

BID LOCATION: Division of Purchasing
CITY OF WARREN
One City Square; 4TH Floor
Warren, MI 48093-5289

END OF SECTION

GENERAL CONDITIONS (rev. 9-9-15)

SIGNATURE

Bids and all information requested of the vendor shall be entered in the appropriate space on the bid form and signature page. Failure to do so may disqualify your offer.

An authorized officer or employee of the bidder shall sign all bids.

BID SUBMISSION

Bids must be submitted by the date specified and at or prior to the time specified to be considered. Late bids, e-mail, telegraphic, or telephone bids will **NOT** be accepted.

Submit one (1) original, one (1) copy and entire bid proposal (with attachments) in PDF electronic format on a USB flash drive to the address shown on the NOTICE INVITATION TO BID, which can usually be found on the first page of the bid document, with a label on the **outside of the ENVELOPE STATING VENDORS NAME, COMMODITY OR SERVICE AND BID NUMBER AND DUE DATE**

RELATIONSHIP DISCLOSURE

It is required that any relationship (business or personal) to a City employee or official be disclosed. This includes employment or other professional engagements.

ALTERATION OF BID DOCUMENTS

Vendor **changes or alterations to the bid documents, including the specification, may result in the bid being considered non-responsive** and/or the bidder being debarred. The only authorized vendor changes to the bid documents will be in the areas provided for the bidder's response including the "Exceptions" section of the bid proposal and on separate attached sheets submitted by the vendor. Vendor must clearly identify, product offered, and deviations from the specification. If a change or alteration to the bid document is undetected, and the bidder is awarded the contract, the original terms, conditions, and specification in the authorized version of the bid document will be applicable during the terms of the contract. Bidders are responsible for ensuring they have obtained all relevant documents including amendments, clarifications, changes, drawings, etc. as made available by the City.

PRICES

Prices quoted shall be for new products in current production unless otherwise specified. Where refurbished or discontinued items are offered they must be clearly identified as such.

Prices quoted shall be exclusive of any rebates due the City of Warren. Any rebates the City of Warren may be entitled to should be shown as a separate line item and include expiration date.

Corrections and/or modifications received after the bid closing time specified will not be accepted.

Unit prices prevail.

All information shall be entered in ink or typewritten. Mistakes may be crossed out and corrections inserted before submission of your bid. The person signing the bid shall initial corrections in ink.

All prices will be bid F.O.B. DESTINATION, INCLUDE ALL DELIVERY AND ANY ADDITIONAL CHARGES and remain in effect as specified in the proposal.

AWARD

Unless otherwise stated in the bid documents, the City of Warren cannot guarantee exclusivity of the contract for the proposed products or services.

Award of the proposals shall be based upon a combination of factors, including but not limited to, adherence to bid requirements, references and any other factors that may be in the City of Warren's best interest.

The City reserves the right to reject any and all bids, and to waive any defect or irregularity in bids. The City reserves the right to accept and separate items in the bid; and to accept the bid that in the opinion of the City is to the best advantage and interest of the public we serve. The City also has the right to re-solicit bids if it is deemed to be in the best interest of the City.

The City reserves the right to reject low bids which have major deviations from our specifications; to accept a higher bid which has only minor deviations. By signing the bid proposal, bidders agree to accept a split award unless bidder takes exception under *Comments*. The bid will be awarded to that responsible, responsive bidder whose bid, conforming to this solicitation, will be most advantageous to the City, with not only price but also availability of product, location and quality of product considered.

The City reserves the right to award all line items, to make no award or to award on an individual line item basis, whichever is deemed to be in the best interest of the City.

Time of delivery may be a consideration in the award.

TERMINATION

1. FAILURE TO PERFORM. The City may terminate a bid award for the failure to perform a term of the bid specifications to the satisfaction of the City. The City shall provide ten (10) days advance written notice to the Bidder for the failure to perform services or for the violation of any other term of the bid specifications. Unless futile or the violation is recurring, the City shall provide notice and the opportunity to cure the violation prior to termination. Such notice to cure shall be given in writing by first-class mail. In the event of a dispute, or in order to avoid interruption of service, the City may engage another to perform the work; and the Bidder shall be responsible for any costs the City incurs as a result of the Bidder's violation. The City may withhold payment to offset any damages the City incurs as a result of the Bidder's violation.

2. AT WILL. A bid award may be terminated at will by the City upon a minimum of thirty (30) days prior written notice to the other party. In the event of termination as provided in this subsection, the bidder will be compensated for all services performed and approvable reimbursable expenses from the inception date to the termination date provided the services performed and the expenses were provided in accordance with the bid specifications. Payment shall be made upon the bidder delivering to the City all information and materials retained by the bidder, affiliates, or subcontractors in performing the services described in the bid specifications, whether completed or in progress.

3. MISREPRESENTATION. In addition, the City may reject this Bid, or cancel a contract with a successful bidder, if there is evidence of any misleading or intentionally fraudulent information or documents provided in connection with this Bid

VENDOR DISCLOSURE

The vendor bidding on this project declares that it has not, nor will it, provide gifts, gift certificates, entertainment, favors, or other gratuities to an City official, City employee, agent, or City volunteer, or their families.

The vendor acknowledges that if it violates this policy then the City may terminate the contract with the vendor.

SPECIFICATION

Brand names and numbers, when used, are for reference to indicate the character or quality desired, unless specifically stated "No Substitutes".

Alternate items of the same quality will be considered, provided your offer clearly describes the article. Offers for alternate items shall state the brand and number, or level or quality. When the bidder does not state brand, or level of quality, it is understood the offer is exactly as specified.

All products and services must be in accordance with all applicable federal, state and local statutes, rules, ordinances, etc.

All personnel must have the appropriate licenses with endorsements for the work performed.

In addition, any personnel driving a vehicle on City property must have a valid driver's license and have or exceed minimum statutory insurance requirements.

E-VERIFY

Any bidder, attesting to his bid by signature is affirming that the contractor/vendor has registered with, participates in and utilizes the E-Verify Program (or any successor program implemented by federal Department of Homeland Security and Social Security Administration to verify the work status of all newly hired employees employed by the contractor/vendor.

NON-IRAN LINKED BUSINESSES

By signing below, I certify and agree on behalf of myself and the company submitting this proposal the following: (1) that I am duly authorized to legally bind the company submitting this proposal; and (2) that the company submitting this proposal is not an "Iran linked business," as that term is defined in Section 2(e) of the Iran Economic Sanctions Act, being Michigan Public Act No. 517 of 2012; and (3) that I and the company submitting this proposal will immediately comply with any further certifications or information submissions requested by the City in this regard.

ASSIGNMENT OF AGREEMENT AND OTHER CONTRACTORS.

The Vendor shall not assign the Agreement or any part thereof without the written consent of the City. The City reserves the right to let other agreements in connection with this work, even if of like character, for Work under an agreement.

PERIOD AGREEMENTS

No Exclusive Contract/Additional Services. Contractor agrees and understands that the contract shall not be construed as an exclusive agreement and further agrees that the City may, at any time, secure similar or identical services at its sole option.

Any contract executed pursuant to this Bid, which is for a specific term shall include for an extension of the contract term at the option of the City as follows:

City shall have the sole option to extend the contract herein for a period of two months by written notice to contractor exercising the option served at least ten days prior to the expiration date of the contract. In the event such option is exercised by City, all of the provisions of the contract shall remain in full force and effect other than the date of expiration of the contract.

The quantities have been estimated for bid award purposes and may be estimated based on past usage. The quantities may increase or decrease and the City makes no representation as to guarantee of usage. The quantities are estimated on an annual basis.

SAMPLES

Sample of articles, when required, shall be furnished free of any cost to the City of Warren. Samples of articles selected may be retained for future comparison. Samples which are not destroyed by testing, or which are not retained for future comparison will be returned upon request at the vendor's expense. Unclaimed samples may be destroyed after one (1) year.

TAXES

If vendor **supplies tangible products only** to the City of Warren, **sales taxes** should **not** be included in your bid as the City of Warren is sales tax exempt.

PAYMENT TERMS

The City's normal payment terms are 45 days in connection with cash discounts specified with this bid. Time will be computed from the date of complete delivery of supplies or equipment as specified, or from the date correct invoices are received in the Office of the City Controller, if the latter is later than the date of delivery. Prices will be considered as net if no cash discount is shown.

MICHIGAN FREEDOM OF INFORMATION ACT (FOIA)

All costs incurred in the preparation and presentation of this proposal, in any way whatsoever, shall be wholly absorbed by the prospective firm. All supporting documentation shall become the property of the City of Warren unless requested otherwise at the time of submission. Michigan FOIA requires the disclosure, upon request, of all public records that are not exempt from disclosure under Section 13 of the Act, which are subject to disclosure under the Act. Therefore, confidentially of information submitted in response to this Request for Proposals is not assured.

EXCEPTIONS TO THE BID SOLICITATION

Each vendor must provide a list of exceptions taken to this bid. Any exceptions taken must be identified and explained in writing. Any exceptions taken must be identified and explained in writing. An exception is defined as the vendor's inability to meet a mandatory requirement or exceed a requirement in the manner specified in the bid solicitation. If the vendor provides an alternative solution when taking an exception to a requirement, the benefits of this alternative solution must be explained. The City reserves the right to accept or reject any exception; whichever is in the best interest of the City.

MATERIAL SAFETY DATA SHEETS

IMPORTANT: All City of Warren purchases require a **MATERIAL SAFETY DATA SHEET** where applicable, in compliance with the **MIOSHA "Right to know"** law.

WITHDRAWAL OF PROPOSAL

Bidders may withdraw their proposals by submitting a written request over the signature of an authorized individual, as described in paragraph 1.6, to the Purchasing Department any time

prior to the submission deadline. Bidders may thereafter submit a new proposal prior to the deadline. Modification or withdrawal of the proposal in any manner, oral or written, will not be considered if submitted after the deadline.

INDEMNITY CLAUSE

To the fullest extent permitted by law, Contractor expressly agrees to indemnify and hold City harmless against all losses and liabilities arising out of or related to bodily injury or property damages based upon any act or omission, negligent or otherwise, of Contractor or anyone acting on contractor's behalf in connection with or incident to this Contract or the work to be performed hereunder, except that contractor shall not be responsible to indemnify the City for losses or damages caused by or resulting from the City's sole negligence.
For the purposes of this indemnity clause, "City" shall mean the City, its elected and appointed officials, employees, authorities, boards and commissions and volunteers working on behalf of the City; "losses and liabilities" shall mean loss, cost, expense, damage, liability or claims, whether groundless or not; "personal injury" shall mean false arrest, erroneous service of civil papers, false imprisonment, malicious prosecution, assault and battery, libel, slander, defamation of character, discrimination, mental anguish, wrongful entry or eviction, violation of property or deprivation of rights, privileges or immunities secured by the constitution and laws of the United States of America or the State of Michigan, for which Vendor may be held liable to the injured party in any action at law, suit in equity or other proceedings for redress; "bodily injury: shall mean bodily injury, sickness or disease (including death resulting at any time there from) mental anguish and mental injury which may be sustained or claimed by any person or persons; and "property damage" shall mean the damage or destruction of any property, including the loss of use thereof.

The contractor's obligation to indemnify and hold the City harmless shall include, but not be limited to (1) the obligation to defend the City from any such suit, action or proceeding, and (2) the obligation to pay any and all judgments which may be recovered in any such suit, action or proceeding, and/or any and all expenses, including but not limited to costs, attorney fees and settlement expenses which may be incurred.

EMPLOYEE RESTRICTIONS

The City of Warren Code of Ordinances restricts sex offenders from local parks. Any person who is a sexual offender may not be employed or engaged to provide services on the park property.

EXTENSION OF AWARD TO THE MITN PURCHASING COOPERATIVE

All vendors awarded contracts from this Bid may, upon mutual agreement, extend pricing to the Michigan Intergovernmental Trade Network (MITN) Purchasing Cooperative. Each entity is responsible for its own payments and is to be considered individually for billing and collection purposes. Each entity will provide their own purchase order and delivery location(s) and must be invoiced separately to the address indicated on their purchase order.

APPENDIX A OF TITLE VI PLAN

During the performance of this contract, the contractor, for itself, its assignees, and successors, in interest (hereinafter referred to as the "contractor") agrees, as follows:

1. COMPLIANCE WITH REGULATIONS. The contractor shall comply with Regulations relative to nondiscrimination in Federally-assisted programs of the Department of Transportation, Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time (hereinafter

referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

2. NONDISCRIMINATION. The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, sex, or national origin in the selection, retention, and treatment of subcontractors, including procurements of materials in the discrimination prohibited by Section 21.5 of the Regulation, including employment practices when the contractor covers a program set for in Appendix B of the Regulations.

3. SOLICITATION FOR SUBCONTRACTS, INCLUDING PROCUREMENTS OF MATERIALS AND EQUIPMENT. In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under the contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.

4. INFORMATION AND REPORTS. The contractor shall provide all information and reports required by the Regulations, or directives issues pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the State Highway Department or the Federal Highway Administration to be pertinent to ascertain compliance with such Regulations or directives. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to the State Highway Department or the Federal Highway Administration, as appropriate, and shall set forth what efforts it has made to obtain the information.

5. SANCTIONS FOR NONCOMPLIANCE. In the event the contractor's noncompliance with the nondiscrimination provisions of this contract, the State Highway Department shall impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to:

a. Withholding payments to the contractor under the contract until the contractor complies and/or

b. Cancellation, termination or suspension of the contract, in whole or in part.

6. INCORPORATION OF PROVISIONS. The contractor shall include provisions of paragraphs (1) through (6) in every subcontract, including procurement of material and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the State Highway Department or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for noncompliance: provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the State Highway Department to enter into such litigation to protect the interests of the State, and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

THE ABOVE GENERAL CONDITIONS ARE CONSIDERED IN FORCE UNLESS SPECIFICALLY ADDRESSED IN ANOTHER SECTION OF THE BID DOCUMENT OR CONTRACT.

LABOR HARMONY ORDINANCE

Sec. 2-334.1. Labor harmony through prevailing wage and benefits for city projects.
(a) *Definitions:*
City project means new construction, alteration, repair, installation, painting, decorating, completing, demolition, conditioning, reconditioning, or improvement of public roads, land either owned by the city or under the direction and control of the city, public buildings or public facilities authorized by a contracting agent, the cost of which is clearly anticipated to be in excess of fifty thousand dollars ($50,000.00). "City project" shall not include work done pursuant to any collective bargaining agreement between the city and its employees.
Construction mechanic means a skilled or unskilled mechanic, laborer, worker, helper, assistant, apprentice, journeyman or other professional designation working on a city project, but shall not include executive, administrative, professional, office or custodial employees.
Contracting agent means any officer, board, commission or authority of the city authorized to enter into a contract for a city project, or to perform a city project by the direct employment of labor.
(b) *Requirements:*
(1) Every contract for a city project which is executed between a contracting agent and a successful bidder or an approved responder to a request for proposal for a city project, entered into pursuant to a request for proposal advertisement and/or an invitation to bid for that city project, which requires or involves the employment of construction mechanics, and which is owned, controlled or financed, in whole or in part, by the city, shall contain an express term that the rates of wages and benefits to be paid to each class of mechanics by the bidder and all of his or her subcontractors shall be not less than the wage and benefits rate prevailing on similar projects in the city. The city's department of public service shall determine the prevailing wage at the rate established by the most recent survey of the Michigan Department of Consumer and Industry Services for prevailing wage determination under Act 166 of the Public Acts of 1965, as amended.
(2) A schedule of the prevailing wage and benefits for the classes of construction mechanics called for in a contract shall be made a part of the specifications for the work to be performed on a city project and shall be printed in the contract forms where work is to be done by contract.
(3) Every contractor and subcontractor on a city project shall keep posted in a conspicuous place on the construction site a copy of all prevailing wage and fringe benefit rates prescribed by the contract and shall keep accurate records showing the name, occupation, and actual wages and benefits paid to each construction mechanic employed by him or her in connection with said contract. This record shall be made available on demand for inspection by the contracting agent or the city.
(4) Contract specifications may include, when appropriate, a requirement that the successful bidder shall enter into a project labor agreement with the Greater Detroit Building and Construction Trades Council, AFL-CIO, and its affiliated unions for the development and construction of the project.
(5) The contracting agent, by written notice to the contractor and the sureties of the contractor known to the contracting agent, shall terminate the contractor's right to proceed with that part of the contract and city project for which less than the prevailing

rates of wages and benefits have been paid or will be paid, and may proceed to complete the contract by separate agreement with another contractor. The contracting agent shall withhold payment for work done until liabilities for unpaid wages and excess costs to the city for reletting the work have been met.

(6) In addition to any penalty provisions provided for in this section, any contractor found to be in volition of this section by any contracting agent shall be prohibited for two (2) years from bidding on any city project, regardless of the anticipated cost of the contract to be bid.

(c) *Exemption.* The requirements set forth in this section will not apply to a project or contract of the City of Warren, or any of its authorities, agencies or departments, including those authorities, agencies and departments created by the City of Warren under statutes of the State of Michigan, if that project or contract is subject to an exemption from labor standards or prevailing wage requirements under federal or state laws or regulations.

(d) *Retroactivity.* The provisions of this section shall not apply to contracts entered into or the bids made before the effective date of this section, or the effective date of an amendment to this section.

(Ord. No. 80-519, § 1, 9-23-97; Ord. No. 80-684, § 1, 3-9-10)

Editor's note: Ord. No. 80-519, § 1, adopted Sept. 23, 1997 amended ch. 2 by the addition of a new section 2-334.2, which provisions have been redesignated at the editor's discretion as section 2-334.1.

MATERIAL FINISH / COLOR SCHEDULE

Spec Section	Item	Description	Product Specified	Finish / Color	Location *(refer to drawings for exact locations)*	Remarks
033000	**CAST IN PLACE CONCRETE**					
	SC-1	Sealed Concrete		Clear	Mechanical and Electrical Rooms	
042000	**UNIT MASONRY**					
	FB-1	Face Brick	Belden Brick	Color: Rum Raisin Finish: Velour		
	FB-2	Salvaged Face Brick	N/A			
	FB-3	Face Brick	Belden Brick		Children's Area - Accent	
	SMB-1	Burnished Masonry Block	Grand Blanc Cement Products	Colors: Forensic, Earthstone, Meadowbrook Finish: Burnished		Equal Blend (3) Colors
	SMB-2	Burnished Masonry Block	Grand Blanc Cement Products	Colors: Forensic, Earthstone, Meadowbrook Finish: Burnished		Equal Blend (3) Colors
	SMB-3	Burnished Masonry Block	Grand Blanc Cement Products	Colors: Forensic, Earthstone, Meadowbrook Finish: Burnished		Equal Blend (3) Colors
	SMB-4	Burnished Masonry Block	Grand Blanc Cement Products	Color: Meadowbrook Finish: Burnished		
		Mortar	Soloman	Custom color to match FB-1	FB-1	
		Mortar	Soloman	Natural	FB-2	
		Mortar	Soloman	Custom color to match SMB-1	SMB-1	
		Mortar	Soloman	Custom color to match SMB-1	SMB-2	
		Mortar	Soloman	Custom color to match SMB-1	SMB-3	

MATERIAL FINISH / COLOR SCHEDULE

Spec Section	Item	Description	Product Specified	Finish / Color	Location *(refer to drawings for exact locations)*	Remarks
		Mortar	Soloman	Custom color to match SMB-1	SMB-4	
047200	**CAST STONE**					
	CS-1	Cast Stone	Royal Stone	As selected from Manufacturer's standard colors	Cast Stone Sills & Wall Caps	
049010	**MASONRY COLOR TREATMENT**					
	CST-1	Concrete Stain	NECT-90	Match Architect's Sample	Site Screen Wall	Alternate #6
064113	**WOOD VENEER FACED ARCHITECTURAL CABINETS**					
	WD-1	Wood Veneer Millwork	Select White Hard Maple	Custom color to match 'ST-1'	Circulation Desk	Run Grain Vertical
074113	**METAL ROOF PANEL**					
	MRP-1	Metal Roof Panel	Peterson Aluminum Corp. (PAC-CLAD)	Silver	Sloped Roof	
074213	**METAL WALL PANEL**					
	MWP-1	Metal Wall Panel	Peterson Aluminum Corp. (PAC-CLAD)	Burgundy	Parapet Walls	
	MWP-2	Metal Wall Panel	Peterson Aluminum Corp. (PAC-CLAD)	Musket Gray	Dormer Walls	
	MWP-3	Metal Wall Panel	Peterson Aluminum Corp. (PAC-CLAD)	Musket Gray	Above Storefronts	
	MWP-4	Metal Wall Panel	Peterson Aluminum Corp. (PAC-CLAD) / Reynobond - Colorweld 500	Anodic Clear	Spandrel	
	MSP-1	Metal Soffit Panel	Peterson Aluminum Corp. (PAC-CLAD)	To match 'MRP-1'	Exterior Soffits	
076200	**SHEET METAL FLASHING AND TRIM**					

MATERIAL FINISH / COLOR SCHEDULE

Spec Section	Item	Description	Product Specified	Finish / Color	Location *(refer to drawings for exact locations)*	Remarks
	MFP-1	Metal Roof Rake / Fascia Panel	Peterson Aluminum Corp. (PAC-CLAD)	To match 'MRP-1'		
	MRE-1	Metal Roof Edge Trim	Peterson Aluminum Corp. (PAC-CLAD)	To match 'MRP-1'		
	MRE-2	Metal Roof Edge Trim	Peterson Aluminum Corp. (PAC-CLAD)	To match 'MWP-1'		
077253	**SNOW GUARDS**					
		Continuous Snow Guards	Peterson Aluminum Corp. (PAC-CLAD)	To match 'MRP-1'		
079200	**JOINT SEALANTS**					
		Sealant at Metal Panels		Custom Match to <u>each</u> Metal Panel type		
		Sealant at Masonry Block		Custom Match to <u>each</u> Masonry Block type		
081416	**FLUSH WOOD DOORS**					
	ST-1	Plain Sliced Select White Maple	Marshfield	Clear 0-95	Interior Doors	
084113	**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**					
		Storefront Frame	Tubelite	Clear Anodized	Storfront Entrances and Windows	
084115	**FIBERGLASS REINFORCED POLYESTER (FRP) DOORS**					
	FRP-1	FRP Door	Special-Lite	Sandstone / As selected from Manufacturer's (9) standard colors	Exterior Mechanical Room Door	
086300	**METAL FRAMED SKYLIGHTS**					
		Skylight	Kalwall CRF	Aluminum #79	Skylight Frames	

MATERIAL FINISH / COLOR SCHEDULE

Spec Section	Item	Description	Product Specified	Finish / Color	Location *(refer to drawings for exact locations)*	Remarks
088000	**GLAZING**					
	IG-10 / IG-11	Colored Glass	PPG IdeaScapes	Azuria / Solarban 60	Exterior Storefront	
093000	**TILING**					
	PT-1	Porcelain Tile	Caesar Contract Solutions - Maison	12" x 24" Field Tile Matte - Perle	Pre-Function, Multi-Purpose Room & Kitchen Floors	
	CT-1	Ceramic Tile	American Olean - Profiles	3" x 6" Field Tile - Ice White 3" x 6" Cove Base - Ice White 3" x 6" Bullnose Edge - Ice White	Restroom Walls - Field	
	CT-2	Ceramic Tile	Stone Tiles International - Bliss Mosaics	5/8" x 5/8" Mosaic Field Tile - Iceland	Restroom Walls - Accent Band	
		Grout	TEC	As selected from Manufacturer's full range	PT-1	
		Grout	TEC	As selected from Manufacturer's full range	CT-1	
		Grout	TEC	As selected from Manufacturer's full range	CT-2	
095123	**ACOUSTICAL TILE CEILINGS**					
	ACT-1	2' x 2' Acoustical Tiles and 15/16" Grid	Tile: USG - Mars .90 NRC Acoustical Panels (SLT Edge) Grid: USG - Donn DX/DXL	White	Multi-Purpose, Teen, Children's & Study Room	
	ACT-2	2' x 4' Acoustical Tiles and 15/16" Grid	Tile: USG - Olympia Micro Illusion Acoustical Panels (SLT Edge) Grid: USG - Donn DX/DXL	White	Closets, Office, Work Area, Kitchen & Storage	
	ACT-3	2' x 2' Acoustical Tiles and 15/16" Grid	Tile: USG - Olympia Micro Acoustical Panels (SLT Edge) Grid: USG - Donn DX/DXL	White	Restrooms	

MATERIAL FINISH / COLOR SCHEDULE

Spec Section	Item	Description	Product Specified	Finish / Color	Location *(refer to drawings for exact locations)*	Remarks
	ACT-4	2' x 4' Metal Ceiling Panel System	USG - Celebrartion Torsion Spring System	Silver Satin	Vestibule	
	ACT-5	2' x 4' Metal Ceiling Tiles and 9/16" Grid	Tile: USG - Panz Perforated Panel with Acoustical Backer (FL Edge / A062 Pattern) Grid: USG - Fineline DXF Grid	Silver Satin	Circulation Desk	
		4" Vertical Metal Fascia Trim	USG - Compasso Standard	White	ACT-1	
		10" Vertical Metal Fascia Trim	USG - Compasso Elite	Silver Satin	ACT-5	
096513	**RESILIENT WALL BASE**					
	RB-1	Coved Resilient Wall Base	Johnsonite Traditional Wall Base	63 'Burnt Umber'		
096816	**CARPET TILES**					
	CPT-1	Carpet Tile	Shaw Contract Group - All Access	Path Tile 5T034 - Ebony 34500	Vestibule & Pre-Function	Pattern: Brick
	CPT-2	Carpet Tile	Shaw Contract Group - Collective Time	Activity Tile 5T089 - Agility 89906	Multi-Purpose, Library & Work Areas	Pattern: Monolithic
099123	**INTERIOR PAINTING**					
	PNT-1	Paint	Sherwin Williams	SW 6041 'Otter'	HM Frames	
	PNT-2	Paint	Sherwin Williams	SW 7007 'Ceiling Bright White'	Exposed Roof Deck (Open Areas)	
	PNT-3	Paint	Sherwin Williams	SW 7014 'Creamy'	Walls - Low	
	PNT-4	Paint	Sherwin Williams	SW 2849 'Westchester Gray'	Walls - Accent Band	

MATERIAL FINISH / COLOR SCHEDULE

Spec Section	Item	Description	Product Specified	Finish / Color	Location *(refer to drawings for exact locations)*	Remarks
	PNT-5	Paint	Sherwin Williams	SW 7611 'Tranquil Aqua'	Walls - High	
	PNT-6	Paint	Sherwin Williams	SW 2827 'Colonial Revival Stone'	Walls - Accent	
	PNT-7	Paint	Sherwin Williams	SW 7066 'Gray Matters'	Exposed Bar Joists	
	PNT-8	Paint	Sherwin Williams	SW 7066 'Gray Matters'	Exposed Steel Beams	
	PNT-9	Paint	Sherwin Williams	SW 6991 'Black Magic'	Exposed Roof Deck (Cloud Areas)	
	PNT-10	Paint	Sherwin Williams	SW 6265 'Quitoxic Plum'	Walls - Accent	
	PNT-11	Paint	Sherwin Williams	SW 6636 'Husky Orange'	Walls - Accent	
	PNT-12	Paint	Sherwin Williams	SW 6711 'Parakeet'	Walls - Accent	
101100	**VISUAL DISPLAY SURFACES**					
	WBD-1	White Board	Claridge	White - Satin Low Gloss (6100S)		
	TBD-1	Tack Board	Claridge	As selected from Manufacturer's standard colors		
101400	**SIGNAGE**					
		LED Halo-Lit Channel Letters	Gemini, Inc.	Custom Color to Match Architect's Sample	14-inch "Warren Public Library"	
		LED Halo-Lit Channel Letters	Gemini, Inc.	Custom Color to Match Architect's Sample	8-inch "Dorothy M. Busch Branch"	
		Flat-Cut Metal Sign	Gemini, Inc.	Custom Color to Match Architect's Sample	City of Warren "W" Logo	
		Cast Aluminum Letters	Gemini, Inc.	Custom Color to Match Architect's Sample	8-inch "Book Return"	

MATERIAL FINISH / COLOR SCHEDULE

Spec Section	Item	Description	Product Specified	Finish / Color	Location *(refer to drawings for exact locations)*	Remarks
		Cast Aluminum Letters	Gemini, Inc.	Custom Color to Match Architect's Sample	6-inch "Dorothy M. Busch Branch"	
		Panel Sign	2/90 Sign Systems	As selected from Manufacturer's standard colors	Interior Room Signs	
102600	**WALL AND DOOR PROTECTION**					
		Corner Guard	C/S Acrovyn	As selected from Manufacturer's 12 textures and 68 solid colors. Color to be selected for each individual location.	Exposed outside gypsum board corners	
		Crash Rail	C/S Acrovyn	As selected from Manufacturer's 12 textures and 68 solid colors. Color to be selected for each individual location.	Multi-Purpose Room, Work Areas	
105113	**METAL LOCKERS**					
		Locker Body	List Industries - Quiet KD Series	As slected from Manufacturer's (24) standard powder coat colors	Locker Door and Body	
122413	**ROLLER SHADES**					
		Sunscreen	Draper, Inc. - Phifer SheerWeave Series 4550	As slected from Manufacturer's (4) standard colors		
		Room Darkening	Draper, Inc. - SunBloc Series SB9100	As slected from Manufacturer's (12) standard colors		
123216	**MANUFACTURED CASEWORK**					
	PL-1	Plastic Laminate	Wilsonart Laminate	4674-60 Evening Tigris	Millwork Countertops: Multi-Purpose Room & Print Station	
	PL-2	Plastic Laminate	Wilsonart Laminate	7909-60 Fusion maple	Millwork Faces: Multi-Purpose Room & Print Station	Run Grain Vertical

MATERIAL FINISH / COLOR SCHEDULE

Spec Section	Item	Description	Product Specified	Finish / Color	Location *(refer to drawings for exact locations)*	Remarks
	PL-3	Plastic Laminate	Wilsonart Laminate	4674-60 Evening Tigris	Millwork Countertops - Kitchen	
	PL-4	Plastic Laminate	Wilsonart Laminate	7909-60 Fusion maple	Millwork Faces - Kitchen	Run Grain Vertical
	SS-1	Solid Surface	Corian	Rosemary	Circulation Desk	High Counter
	SS-2	Solid Surface	Corian	Whipped Cream	Window Sills	
	SS-3	Solid Surface	Corian	Acorn	Circulation Desk	Low Counter
	PVC	PVC Edge Banding	Doellken	Match each plastic laminate		
321313	**CONCRETE PAVING**					
	CC-1	Intergral Colored Concrete	Brickform	As selected from manufacturer's (40) Stock and Standard Colors	Entry Plaza - Color 1	
	CC-2	Intergral Colored Concrete	Brickform	As selected from manufacturer's (40) Stock and Standard Colors	Entry Plaza - Color 2	

AIA® Document A701™ – 1997

Instructions to Bidders

for the following PROJECT:
(Name and location or address)
Dorothy M. Busch Library
23333 Ryan Road
Warren, MI 48091

THE OWNER:
(Name, legal status and address)
City of Warren
One City Square, 4th Floor
Warren, MI 48093-5289

THE ARCHITECT:
(Name, legal status and address)
PARTNERS in Architecture, PLC
65 Market Street
Mount Clemens, MI 48043

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

TABLE OF ARTICLES

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.3 SUBSTITUTIONS

§ 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.2 OWNER'S FINANCIAL CAPABILITY

The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 SUBMITTALS

§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

- **.1** a designation of the Work to be performed with the Bidder's own forces;
- **.2** names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
- **.3** names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder's usual sources.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

DOCUMENT 002213 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

A. Instructions to Bidders for Project consist of the following:

1. AIA Document A701, "Instructions to Bidders," a copy of which is bound in this Project Manual.
2. The following Supplementary Instructions to Bidders modify and add to the requirements of the Instructions to Bidders.

1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

A. The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

1.3 ARTICLE 1 - DEFINITIONS

A. No modifications.

1.4 ARTICLE 2 - BIDDER'S REPRESENTATIONS

A. Add Section 2.1.3.1:

1. 2.1.3.1 - The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.

B. Add Section 2.1.5:

1. 2.1.5 - The Bidder is a properly licensed Contractor according to the laws and regulations of The State of Michigan and meets qualifications indicated in the Procurement and Contracting Documents.

C. Add Section 2.1.6:

1. 2.1.6 - The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

D. Add Section 2.1.7:

1. 2.1.7 – The Bidder understands that this project is a prevailing wage project.

1.5 ARTICLE 3 - BIDDING DOCUMENTS

A. Delete Paragraph 3.1.1 in its entirety and substitute the following:

1. 3.1.1 - Bidders may obtain up to two (2) complete set of bidding documents from the Architect at the cost as listed in the Advertisement for Bids. Additional sets are available at direct cost to the bidder. Electronic sets (PDF format) are available at no cost.

B. Add Section 3.3.5:

1. 3.3.5 - Where the Contractor chooses to use an item approved by request but other than one shown on the details or specified, he shall be responsible for the coordination of any necessary changes in other work, and shall bear the cost of such changes.

C. 3.4 - Addenda:

1. Delete Section 3.4.3 and replace with the following:

a. 3.4.3 - Addenda may be issued at any time prior to the receipt of bids.

2. Add Section 3.4.4.1:

a. 3.4.4.1 - Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:

1) 3.4.4.1.1 - Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.
2) 3.4.4.1.2 - Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

1.6 ARTICLE 4 - BIDDING PROCEDURES

A. 4.1 - Preparation of Bids:

1. Add Section 4.1.9:

a. 4.1.9 - Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

B. Delete Section 4.2.1 in its entirety and substitute the following:

1. 4.2.1 - No bid will be considered, unless it is accompanied by a certified check or acceptable Bid Bond payable without condition to the Owner, in an amount equal to (5%) of the total bid. The certified check or Bid Bond which must accompany each bid is required as a guarantee that the bidder will enter into a contract with the Owner for the work described in the proposal and furnish a performance and payment bond and certificates of insurance as specified after notice by the Owner or Architect that contracts have been awarded to him and are ready for execution.

C. Add Section 4.2.3.1:

1. 4.2.3.1 - The Bid Security of the three lowest bidders will be retained until the contract has been awarded and executed, but not longer than (75) days. The Bid Security of other bidders will be returned within a reasonable time after the opening of bids.

D. 4.3 – Submission of Bids

1. Add Section 4.3.5: The Bidder shall submit with their bid the following information:

a. A completed Contractor's Qualification Statement per Specification section 003111.
b. Bid Security.

E. 4.4 - Modification or Withdrawal of Bids:

1. Add Section 4.4.1.1:
a. 4.4.1.1 – Bids may not be withdrawn for a period of ninety (90) days from the bid opening date.

F. 4.5 - Break-Out Pricing Bid Supplement:

1. Add Section 4.5:

a. 4.5 - Provide detailed cost breakdowns (schedule of values) no later than two business days following Architect's request.

G. 4.6 - Subcontractors, Suppliers, and Manufacturers List Bid Supplement:

1. Add Section 4.6:

a. 4.6 - Provide list of major subcontractors, suppliers, and manufacturers furnishing or installing products no later than two business days following Architect's request. Include those subcontractors, suppliers, and manufacturers providing work totaling three percent or more of the Bid amount. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Architect.

1.7 ARTICLE 5 - CONSIDERATION OF BIDS

A. 5.2 - Rejection of Bids:

1. Add Section 5.2.1:

a. 5.2.1 - Owner reserves the right to reject a bid based on Owner's and Architect's evaluation of qualification information submitted with the bid as well as following the opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

1.8 ARTICLE 6 - POSTBID INFORMATION

A. 6.1 - Contractor's Qualification Statement:

1. Add Section 6.1.1:

a. 6.1.1 - Contractor's Qualification Statement is to be submitted with bid.

B. 6.3 - Submittals:

1. Add Section 6.3.1.4:

a. 6.3.1.4 - Submit information requested in Sections 6.3.1.1, 6.3.1.2, and 6.3.1.3 no later than two business days following Architect's request.

1.9 ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

A. 7.1 - Bond Requirements:

1. Add Section 7.1.1.1:

a. 7.1.1.1 - Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.

B. 7.2 - Time of Delivery and Form of Bonds:

1. Delete the first sentence of Section 7.2.1 and insert the following:

a. The Bidder shall deliver the required bonds to Owner no later than 10 days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.

2. Delete Section 7.2.3 and insert the following:

a. 7.2.3 - Bonds shall be executed and be in force on the date of the execution of the Contract.

1.10 ARTICLE 9 - EXECUTION OF THE CONTRACT

A. Add Article 9:

1. 9.1.1 - Subsequent to the Notice of Intent to Award, and within 10 days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through Architect in such number of counterparts as Owner may require.
2. 9.1.2 - Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.
3. 9.1.3 - Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement.

4. 9.1.4 - In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

END OF DOCUMENT 002213

SECTION 003000 –REQUIRED BID SUBMISSION MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Following this page is the Bid Form. Bidder must completely fill out the Bid Form and Submit (1) original, (1) copy and (1) copy in electronic format on USB thumb drive, by the date and time specified.

B. Bidder must submit with the bid, “Bid Security” as described in specifications section 002213.

C. Bidder must submit a Complete Contractor’s Qualification Statement in accordance with Specification Section 003111.

BID FORM

CITY OF WARREN PROJECT NUMBER: ITB-W-9330

BID PROPOSAL FOR: **City of Warren – Dorothy M. Busch Library**

BID TO: **DIVISION OF PURCHASING,**
CITY OF WARREN,
ONE CITY SQUARE, 4TH FLOOR
WARREN, MI 48093-5289

BID DUE DATE: **FEBRUARY 10, 2016; 12:30PM**

BIDDERS NAME: _____

We have examined the Contract Documents for the proposed **City of Warren – Dorothy M. Busch Library** project as prepared by PARTNERS in Architecture, PLC.

In accordance therewith, the undersigned proposes to furnish all labor and materials for construction as set forth in the Contract Documents, including the following Addenda, if any (fill in the addenda number, thus confirming receipt):

Addendum Number _____ Addendum Number _____

Addendum Number _____ Addendum Number _____

1. Accompanying the proposal is a bid security for work required to be furnished by the Contract Documents, the same being subject to forfeiture in the event of default by the undersigned.

2. I agree to complete the Project, by the dates listed in Specification Section 011000 – Summary; provided that a notice to proceed is issued within thirty (30) days.

3. I understand that the Owner reserves the right to reject any or all bids, and it is agreed that this bid may not be withdrawn for a period of ninety (90) days from the opening thereof.

5. Attached herewith are the documents requested in the Supplementary Instructions to Bidders, Specification Section 002213, paragraph 4.3.5.

A. BASE BID: (Insert a base bid amount in the blank provided).

_____Dollars $_____

B. ALTERNATES: Refer to section 012300 for a complete description

1. Alternate No. 1: Replacement of Existing North Sidewalk

   Add: $ _____

2. Alternate No. 2: Decorative "City of Warren Logo" in Entrance Plaza Concrete

   Add: $ _____

3. Alternate No. 3: Side Folding Gate in Pre-Function Area

   Add: $ _____

4. Alternate No. 4: Provide Standard Acoustical Roof Deck in Lieu of Epic Deck

   Add / Deduct: $ _____

5. Alternate No. 5: Monument Sign

   Add: $ _____

6. Alternate No. 6: Concrete Screen Wall Staining

   Add: $ _____

7. Alternate No. 7: Building Management System

   Add: $ _____

C. ALLOWANCES: Refer to section 012100 for a complete description

(These amounts are included in the "Base Bid" amount listed on the bid form)

1. Allowance No. 1: Owner's Contingency Allowance — $ _____ (*Enter value of allowance)*

2. Allowance No. 2: Soil Corrections Allowance *(This allowance should correlate with unit price #1)* — $ _____ (*Enter value of allowance, based on quantity and unit price)*

D. UNIT PRICES: Refer to section 012200 for a complete description

1. Unit Price No. 1: Undercutting Subgrade — $_____ per Cu. Yd. (*Enter value of unit price)*

E. SCHEDULE: Refer to Specification Section 011000 for schedule requirements.

_____
(Fill in proposed construction completion date)

F. NON-IRAN LINKED BUSINESSES

By signing below, I certify and agree on behalf of myself and the company submitting this proposal the following: (1) that I am duly authorized to legally bind the company submitting this proposal; and (2) that the company submitting this proposal is not an "Iran linked business," as that term is defined in Section 2(e) of the Iran Economic Sanctions Act, being Michigan Public Act No. 517 of 2012; and (3) that I and the company submitting this proposal will immediately comply with any further certifications or information submissions requested by the City in this regard.

G. COMPANY / CONTACT INFORMATION

Company Name:_____

Contact Name:_____

Address:_____

Phone Number: _____ Cell Number: _____

Email: _____

Corporate Officer Name:_____Title_____

Corporate Officer Signature:_____ Date:_____

Federal ID Number : _____

END OF BID FORM

SECTION 003110 – PREVAILING WAGES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

PART 2 – SCOPE

2.1 PREVAILING WAGES

A. In any Agreement entered into pursuant to this advertisement, the Contractor shall comply with the provisions of the PREVAILING WAGE LAW.

The Contractor will pay the latest prevailing wages and fringe benefits for all Work as required by State of Michigan/Public Act 166 dated 1965 as amended or OTHER APPLICABLE PREVAILING WAGE LAW. The prevailing wage and fringe benefit rates are included immediately behind this Section

B. Additionally, Contractor is required to comply with all other provisions of the governing prevailing wage law, and shall ensure its Subordinate Parties' compliance therewith.

C. Allegations that individuals working on this Project are not receiving compensation required by law are considered seriously by the Owner. In order to expedite the resolution of prevailing wage complaints related to this Project, the Owner has determined that the Michigan Fair Contracting Center ("MFCC") is the organization best equipped to expedite the investigation of these matters. Any person or entity (the "Complainant") who reasonably believes that a particular contractor, subcontractor, sub-subcontractor, supplier or other person or entity providing labor, materials, goods or services on this Project (each, an "Employer") is not paying prevailing wages as required by applicable law may ask the MFCC to determine whether proper rates are being paid either by completing and submitting to MFCC a request for assistance (the "RFA") or by contacting MFCC by telephone at (734) 462-2330 or (877) 611-6322. The RFA can be downloaded electronically at http://mifcc.org/Brochures/KnowYourRights.pdf and delivered to MFCC by facsimile to (734) 462-2318 or by mail to P.O. Box 530492, Livonia, Michigan 48153-0492.

D. Each and every Employer who is subject to an audit by MFCC pursuant to any RFA shall cooperate and comply fully with all requests, requirements and inquiries of MFCC. If, after investigation, MFCC determines that a Complainant's allegations are meritorious and the Complainant, MFCC and the Employer are unable to resolve the dispute following MFCC's determination, then, under the direction and with the assistance of MFCC, the Complainant shall file a Prevailing Wage Complaint (the "PWC") with the State of Michigan Department of Labor and Economic Growth Wage and Hour Division (the "Wage and Hour Division"). The PWC can be downloaded electronically at http://mifcc.org/Brochures/PrevailingWageComplaint.pdf and delivered by facsimile to (517) 322-6352 or by mail to 7150 Harris Drive, P.O. Box 30476, Lansing, Michigan 48909-7076.

1. Upon commencement of the audit from MFCC, the Owner reserves the right to hold all payments, pending the conclusion of the audit. If the Wage and Hour Division determines that the Employer

has violated any applicable prevailing wage law, then the Owner shall automatically be entitled to and will (a) withhold from such Employer any and all payments due and owing until the Employer remedies any and all violations cited by the Wage and Hour Division, and (b) back charge the Employer for all costs actually incurred in MFCC's audit of the Employer.

2. The Contractor must keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates as prescribed in the Contract and the address and telephone number of the DELEG's Wage and Hour Division office responsible for enforcing these provisions, and must keep an accurate record showing the name and classification of each Person performing Work on the site, the dates on which Work was performed, the hours each Person worked on the site and the actual hourly wage and benefits paid to each Person. This record must be notarized by a Notary Public and must be available to the Owner and DELEG for an audit or inspection, at any time, upon their request. In addition, the Contractor must have available to DELEG, certified payroll of those working on the project.

3. If any trade is omitted from the schedule of wages and fringe benefit rates included immediately behind this Section, the trades omitted must also be paid not less than the wage and fringe benefit rates prevailing in the locality in which the Work is to be performed.

E. The Contractor shall be financially responsible for the payment of prevailing wages by all Subordinate Parties that are subject to the prevailing wage law for Work on the Project.

F. Because Work on this Project is covered by the Michigan Prevailing Wage Act ("Act"), the Contractor and its subcontractors and other Subordinate Parties that are governed by the prevailing wage law shall pay all hours at the prevailing wage rates at the applicable hourly rate; no Work performed by or on behalf of the Contractor on this Project will be paid on a lump sum basis or a piece rate basis in violation of the Act.

G. The Contractor will pay its workers at wage and fringe benefit rates consistent with the Act regardless of whether the workers are classified as employees or independent contractors.

H. The Contractor shall not misclassify any work assignments, but shall in each and every case follow proper jurisdictional assignments in compliance with the Act.

I. The Contractor shall assure that any persons paid at apprentice rates under the Act are properly classified as apprentices by actual participation in a BAT certified program or as may otherwise be permitted by the Act.

END OF SECTION 003110

2016 Prevailing Wage Rates for State Funded Projects

Macomb County

Classification Name / Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Asbestos & Lead Abatement Laborer					
Asbestos & Lead Abatement Laborer 4 ten hour days @ straight time allowed Monday-Saturday, must be consecutive calendar days	MLDC	$40.75	$54.34	$67.93	H H H X X X X D Y
Asbestos & Lead Abatement, Hazardous Material Handler					
Asbestos and Lead Abatement, Hazardous Material Handler 4 ten hour days @ straight time allowed Monday-Saturday, must be consecutive calendar days	AS207	$40.75	$54.25	$67.75	H H H X X X X D Y
Boilermaker					
Boilermaker	BO169	$54.70	$81.08	$107.45	H H H H H H H D Y
	Apprentice Rates:				
	1st 6 months	$40.31	$59.49	$78.67	
	2nd 6 months	$41.45	$61.21	$80.95	
	3rd 6 months	$42.57	$62.88	$83.19	
	4th 6 months	$43.69	$64.57	$85.43	
	5th 6 months	$44.81	$66.24	$87.67	
	6th 6 months	$48.63	$72.50	$96.36	
	7th 6 months	$49.32	$73.01	$96.69	
	8th 6 months	$51.58	$76.40	$101.21	

For Informational Purposes Only Not For Use In Contract

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Bricklayer						
Bricklayer, stone mason, pointer, cleaner, caulker		BR1	$52.43	$78.65	$104.86	H H D H D D D D Y
Make up day allowed	Comment Saturday for 5 day 8 hour week Friday for 4 day 10 hour week 4 10s allowed M-TH					
	Apprentice Rates:					
	First 6 months		$31.87	$47.81	$63.74	
	2nd 6 months		$33.72	$50.60	$67.44	
	3rd 6 months		$35.57	$53.37	$71.14	
	4th 6 months		$37.42	$56.14	$74.84	
	5th 6 months		$39.27	$58.92	$78.54	
	6th 6 months		$41.12	$61.70	$82.24	
	7th 6 months		$42.97	$64.46	$85.94	
	8th 6 months		$44.82	$67.24	$89.64	
Carpenter						
Diver Four 10s allowed M-Sat; double time due when over 12 hours worked per day		CA 687 D	$66.46	$95.70	$124.93	X X H X X H H D Y
Make up day allowed	Comment Saturday					
Carpet and Resilient Floor Layer, (does not include installation of prefabricated formica & parquet flooring which is to be paid carpenter rate)		CA1045	$50.21	$71.55	$92.89	X X H X X X X D Y
	Apprentice Rates:					
	1st 6 months		$24.86	$33.53	$42.19	
	2nd 6 months		$28.87	$39.54	$50.21	
	3rd 6 months		$31.01	$42.76	$54.49	
	4th 6 months		$33.14	$45.95	$58.75	
	5th 6 months		$35.28	$49.16	$63.03	
	6th 6 months		$37.41	$52.36	$67.29	
	7th 6 months		$39.54	$55.54	$71.55	
	8th 6 months		$41.67	$58.74	$75.81	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Carpenter	four 10s allowed Mon-Sat; double time due when over 12 hours worked per day	CA687Z1	$56.59	$80.89	$105.19	X X H X X H H D Y
Make up day allowed	Comment: Saturdays					
		Apprentice Rates:				
		1st year	$34.72	$48.09	$61.45	
		3rd 6 months	$37.16	$51.75	$66.33	
		4th 6 months	$39.58	$55.38	$71.17	
		5th 6 months	$42.02	$59.04	$76.05	
		6th 6 months	$44.44	$62.67	$80.89	
		7th 6 months	$46.87	$66.32	$85.75	
		8th 6 months	$49.30	$69.96	$90.61	
Piledriver	Four 10s allowed Monday-Saturday; double time due when over 12 hours worked per day	CA687Z1P	$56.59	$80.89	$105.19	X X H X X H H D Y
Make up day allowed	Comment: Saturday					
		Apprentice Rates:				
		1st 6 months	$34.72	$48.09	$61.45	
		2nd 6 months	$39.58	$55.38	$71.17	
		3rd 6 months	$44.44	$62.67	$80.89	
		4th 6 months	$49.30	$69.96	$90.61	
Cement Mason						
Cement Mason		br1cm	$50.05	$71.17	$92.28	X X H H H H H D N
		Apprentice Rates:				
		1st 6 months	$29.13	$39.45	$49.77	
		2nd 6 months	$31.20	$42.54	$53.87	
		3rd 6 months	$35.31	$48.67	$62.01	
		4th 6 months	$39.46	$54.85	$70.23	
		5th 6 months	$41.52	$57.91	$74.30	
		6th 6 months	$45.67	$64.10	$82.52	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Cement Mason		CE514	$46.30	$64.89	$83.48	H H D H H H H D N
		Apprentice Rates:				
		1st 6 months	$26.77	$36.07	$45.36	
		2nd 6 months	$28.68	$38.91	$49.13	
		3rd 6 months	$32.50	$44.59	$56.66	
		4th 6 months	$36.32	$50.26	$64.19	
		5th 6 months	$38.24	$53.11	$67.98	
		6th 6 months	$42.06	$58.79	$75.51	
Drywall						
Drywall Taper Four 10s allowed Monday-Thursday		PT-22-D	$45.16	$58.69	$72.21	H H D H D D D D Y
Make up day allowed	Comment					
	Friday make-up day	for bad weather or holidays				
		Apprentice Rates:				
		First 3 months	$31.63	$38.39	$45.15	
		Second 3 months	$34.34	$42.45	$50.57	
		Second 6 months	$37.04	$46.51	$55.97	
		Third 6 months	$39.75	$50.57	$61.39	
		4th 6 months	$41.10	$52.59	$64.09	
Electrician						
Inside Wireman		EC-58-IW	$60.09	$79.08	$98.07	H H H H H H H D N
		Apprentice Rates:				
		0-1000 hours	$37.29	$44.88	$52.48	
		1000-2000 hours	$39.20	$47.75	$56.30	
		2000-3500 hours	$41.09	$50.59	$60.08	
		3500-5000 hours	$42.99	$53.44	$63.88	
		5000-6500 hours	$46.79	$59.14	$71.48	
		6500-8000 hours	$50.59	$64.84	$79.08	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Sound and Communication Installer		EC-58-SC	$38.11	$51.23	$64.35	H H H H H H H D N
	Apprentice Rates:					
	Period 1		$24.99	$31.55	$38.11	
	Period 2		$26.30	$33.52	$40.73	
	Period 3		$27.62	$35.50	$43.37	
	Period 4		$28.93	$37.46	$45.99	
	Period 5		$30.25	$39.44	$48.63	
	Period 6		$31.55	$41.39	$51.23	
Elevator Constructor						
Elevator Constructor Elevator Constructor Make up day allowed		EL 36	$56.46		$94.99	D D D D D D D D Y
	Apprentice Rates:					
	1st Year Apprentice		$37.74		$58.93	
	2nd Year Apprentice		$41.90		$66.94	
	3rd Year Apprentice		$43.98		$70.95	
	4th Year Apprentice		$48.14		$78.96	
Glazier						
Glazier If a four 10 hour day workweek is scheduled, four 10s must be consecutive, M-F.		GL-357	$48.10	$66.84	$85.58	H H H H H H H D Y
	Apprentice Rates:					
	1st 6 months		$33.07	$44.30	$55.52	
	2nd 6 months		$34.58	$46.57	$58.54	
	3rd 6 months		$37.58	$51.07	$64.54	
	4th 6 months		$39.09	$53.33	$67.56	
	5th 6 months		$40.59	$55.58	$70.56	
	6th 6 months		$42.09	$57.83	$73.56	
	7th 6 months		$43.59	$60.08	$76.56	
	8th 6 months		$46.60	$64.59	$82.58	
Heat and Frost Insulator						
Spray Insulation		AS25S	$20.14	$29.14		H H H H H H H H N

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Heat and Frost Insulator and Asbestos Worker						
Heat and Frost Insulators and Asbestos Workers	Four 10s must be worked for a minimum of 2 weeks consecutively, Monday thru Thursday. All hours worked in excess of 10 will be paid at double time. All hours worked on the fifth day, Monday thru Friday will paid at time and one-half.	AS25	$60.25	$76.00	$91.74	H H H H H H H D Y
	Comment: Four 10s must be worked for a minimum of 2 consecutive weeks. OVERTIME is different on a four 10 week. OT is 2x for hours beyond 10. All hours on fifth day, M-F require time and one half. Sat first 8 hours, 1.5, all hours after 8 require double time.					
	Apprentice Rates:					
	1st Year		$46.08	$54.74	$63.40	
	2nd Year		$49.23	$59.46	$69.70	
	3rd Year		$50.80	$61.82	$72.84	
	4th Year		$53.95	$66.54	$79.14	
Ironworker						
Fence, Sound Barrier & Guardrail erection/installation and Exterior Signage work	Four ten hour work days may be worked during Monday-Saturday.	IR-25-F1	$34.65	$46.65	$58.65	X X H X X X H D Y
	Apprentice Rates:					
	60% Level		$24.25	$31.45	$38.65	
	65% Level		$25.55	$33.35	$41.15	
	70% Level		$26.86	$35.26	$43.66	
	75% Level		$28.15	$37.15	$46.15	
	80% Level		$29.45	$39.05	$48.65	
	85% Level		$30.75	$40.95	$51.15	
Siding, Glazing, Curtain Wall	4 tens may be worked Monday thru Thursday @ straight time.	IR-25-GZ2	$47.16	$58.82	$70.48	X X H H H H D D Y
Make up day allowed	Comment: Friday					
	Apprentice Rates:					
	Level 1		$30.23	$36.84	$43.43	
	Level 2		$32.34	$39.58	$46.80	
	Level 3		$34.46	$42.33	$50.19	
	Level 4		$36.58	$45.08	$53.57	
	Level 5		$38.69	$47.82	$56.95	
	Level 6		$40.81	$50.57	$60.33	

Classification Name / Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Pre-engineered Metal Work	IR-25-PE-Z1	$46.49	$56.78	$67.06	X X H X X X X D Y
Make up day allowed	Comment: 4 tens allowed M-Th with Saturday make up day				
	Apprentice Rates:				
	1st Year	$27.36	$32.83	$38.31	
	3rd 6 month period	$29.48	$35.71	$41.93	
	4th 6 month period	$31.61	$38.60	$45.58	
	5th 6 month period	$33.73	$41.46	$49.20	
	6th 6 month period	$35.86	$45.24	$54.62	
Reinforced Iron Work	IR-25-RF	$56.11	$84.03	$111.95	H H D H D D D D N
Make up day allowed					
	Apprentice Rates:				
	Level 1	$36.76	$54.83	$72.88	
	Level 2	$39.13	$58.37	$77.62	
	Level 3	$41.49	$61.92	$82.34	
	Level 4	$44.03	$65.72	$87.42	
	Level 5	$46.56	$69.53	$92.48	
	Level 6	$49.10	$73.33	$97.56	
Rigging Work	IR-25-RIG	$62.08	$92.78	$123.47	H H H H H H H D N
	Apprentice Rates:				
	Level 1& 2	$37.38	$55.69	$74.01	
	Level 3	$40.21	$59.94	$79.67	
	Level 4	$43.03	$64.17	$85.31	
	Level 5	$45.86	$68.42	$90.97	
	Level 6	$48.69	$72.67	$96.63	
Decking 4 tens may be worked Monday thru Thursday @ straight time. If bad weather, Friday may be a make up day. If holiday celebrated on a Monday, 4 10s may be worked Tuesday thru Friday. Work in excess of 12 hours per day must be paid @ double time.	IR-25-SD	$54.04	$80.73	$107.42	X X H H H H D D Y
Make up day allowed	Comment: Friday for 4 tens M-Th Saturday for 5 eights M-F				

Classification Name / Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Structural, ornamental, welder and pre-cast 4 tens may be worked Monday thru Thursday @ straight time. If bad weather, Friday may be a make up day. If holiday celebrated on a Monday, 4 10s may be worked Tuesday thru Friday. Work in excess of 12 hours per day must be paid @ double time. Make up day allowed	IR-25-STR	$62.21	$92.94	$123.67	H H H H H H D D Y
Apprentice Rates:					
	Levels 1 & 2	$36.79	$55.10	$73.42	
	Level 3	$39.62	$59.35	$79.08	
	Level 4	$42.44	$63.58	$84.72	
	Level 5	$45.27	$67.83	$90.38	
	Level 6	$48.10	$72.08	$96.04	
	Level 7	$50.92	$76.30	$101.68	
	Level 8	$53.75	$80.55	$107.34	
Industrial Door erection & construction Make up day allowed Comment Friday for bad weather when 4 tens scheduled for M-Th. If holiday celebrated on M, 4 tens may be worked T-F. Work in excess of 12 hours per day must be paid @ double time.	IR-25-STR-D	$42.54	$63.44	$84.34	H H H H H H D D Y
Laborer					
Construction Laborer, Demolition Laborer, Mason Tender,Carpenter Tender, Drywall Handler, Concrete Laborer, Cement Finisher Tender, Concrete Chute, and Concrete Bucket Handler If conditions beyond the employer/employee's control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time. Make up day allowed Comment Saturday	L33401-A-CC	$43.94	$62.52	$81.09	H H H H H H H D Y
Apprentice Rates:					
	0-1,000 work hours	$37.97	$53.56	$69.15	
	1,001 - 2,000 work hours	$39.16	$55.34	$71.53	
	2,001 - 3,000 work hours	$40.36	$57.14	$73.93	
	3,001 - 4,000 work hours	$42.75	$60.73	$78.71	

Classification Name / Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Signal Man (on sewer & caisson work), Air, Electric or Gasoline Tool Operator, Concrete Vibrator Operator, Acetylene Torch & Air Hammer Operator; Scaffold Builder, Caisson Worker If conditions beyond the employer/employee's control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time. Make up day allowed: Saturday Comment:	L33401-B-SB	$44.21	$62.92	$81.63	H H H H H H H D Y
Furnace Battery Heater Tender, Burning Bar & Oxy-Acetylene Gun If conditions beyond the employer/employee's control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time. Make up day allowed: Saturday Comment:	L33401-D-HH	$44.45	$63.28	$82.11	H H H H H H H D Y
Expediter Man, Top Man and/or Bottom Man (Blast Furnace Work or Battery Work) If conditions beyond the employer/employee's control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time. Make up day allowed: Saturday Comment:	L33401-E-EX	$45.21	$64.42	$83.63	H H H H H H H D Y
Cleaner/Sweeper Laborer; Furniture Laborer If conditions beyond the employer/employee's control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time. Make up day allowed: Saturday Comment:	L33401-F-CL	$38.49	$54.34	$70.19	H H H H H H H D Y
Lansing Burner, Blaster & Powder Man; Air, Electric or Gasoline Tool Operator (Blast Furance Work or Battery Work) Make up day allowed: Saturday Comment:	L334C	$44.71	$63.67	$82.63	X X H X H H H D Y

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Plasterer Tender, Plastering Machine Operator		LPT-1	$43.94	$62.52	$81.09	X X H H H H H D Y
If conditions beyond the employer/employee's control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time.						
Make up day allowed	Comment					
	Saturday					
	Apprentice Rates:					
	1,001 - 2,000 hours		$39.16	$55.34	$71.53	
	2,001 - 3,000 hours		$40.36	$57.14	$73.93	
	3,001 - 4,000 hours		$42.75	$60.73	$78.71	
Laborer - Hazardous						
Class A performing work in conjunction with site preparation and other preliminary work prior to actual removal, handling, or containment of hazardous waste substances not requiring use of personal protective equipment required by state or federal regulations; or a laborer performing work in conjunction with the removal, handling, or containment of hazardous waste substances when use of personal protective equipment level "D" is required.		LHAZ-Z1-A	$43.54	$61.94	$80.33	H H H H H H H D Y
Make up day allowed	Comment					
	4 10s allowed M-Th or T-F; inclement weather makeup day Friday					
	Apprentice Rates:					
	0-1,000 work hours		$37.60	$53.03	$68.45	
	1,001-2,000 work hours		$38.79	$54.81	$70.83	
	2,001-3,000 work hours		$39.98	$56.60	$73.21	
	3,001-4,000 work hours		$42.35	$60.15	$77.95	
Class B performing work in conjunction with the removal, handling, or containment of hazardous waste substances when the use of personal protective equipment levels "A", "B" or "C" is required.		LHAZ-Z1-B	$44.54	$63.44	$82.33	H H H H H H H D Y
Make up day allowed	Comment					
	4 10s allowed M-Th or T-F; inclement weather makeup day Friday					
	Apprentice Rates:					
	0-1,000 work hours		$38.36	$54.17	$69.97	
	1,001-2,000 work hours		$39.59	$56.01	$72.43	
	2,001-3,000 work hours		$40.83	$57.87	$74.91	
	3,001-4,000 work hours		$43.30	$61.58	$79.85	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Laborer Underground - Tunnel, Shaft & Caisson						
Class I - Tunnel, shaft and caisson laborer, dump man, shanty man, hog house tender, testing man (on gas), and watchman.		LAUCT-Z1-1	$37.87	$48.66	$59.44	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.05	$41.43	$49.80	
	1,001-2,000 work hours		$34.02	$42.88	$51.74	
	2,001-3,000 work hours		$34.98	$44.32	$53.66	
	3,001-4,000 work hours		$36.91	$47.21	$57.52	
Class II - Manhole, headwall, catch basin builder, bricklayer tender, mortar man, material mixer, fence erector, and guard rail builder.		LAUCT-Z1-2	$37.98	$48.82	$59.66	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.14	$41.56	$49.98	
	1,001-2,000 work hours		$34.10	$43.00	$51.90	
	2,001-3,000 work hours		$35.07	$44.45	$53.84	
	3,001-4,000 work hours		$37.01	$47.37	$57.72	
Class III - Air tool operator (jack hammer man, bush hammer man and grinding man), first bottom man, second bottom man, cage tender, car pusher, carrier man, concrete man, concrete form man, concrete repair man, cement invert laborer, cement finisher, concrete shoveler, conveyor man, floor man, gasoline and electric tool operator, gunnite man, grout operator, welder, heading dinky man, inside lock tender, pea gravel operator, pump man, outside lock tender, scaffold man, top signal man, switch man, track man, tugger man, utility man, vibrator man, winch operator, pipe jacking man, wagon drill and air track operator and concrete saw operator (under 40 h.p.).		LAUCT-Z1-3	$38.04	$48.91	$59.78	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.18	$41.62	$50.06	
	1,001-2,000 work hours		$34.15	$43.07	$52.00	
	2,001-3,000 work hours		$35.12	$44.53	$53.94	
	3,001-4,000 work hours		$37.07	$47.45	$57.84	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Class IV - Tunnel, shaft and caisson mucker, bracer man, liner plate man, long haul dinky driver and well point man.		LAUCT-Z1-4	$38.22	$49.18	$60.14	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.32	$41.83	$50.34	
	1,001-2,000 work hours		$34.30	$43.30	$52.30	
	2,001-3,000 work hours		$35.28	$44.77	$54.26	
	3,001-4,000 work hours		$37.24	$47.71	$58.18	
Class V - Tunnel, shaft and caisson miner, drill runner, keyboard operator, power knife operator, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars)		LAUCT-Z1-5	$38.47	$49.56	$60.64	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.50	$42.10	$50.70	
	1,001-2,000 work hours		$34.50	$43.60	$52.70	
	2,001-3,000 work hours		$35.49	$45.09	$54.68	
	3,001-4,000 work hours		$37.48	$48.07	$58.66	
Class VI - Dynamite man and powder man.		LAUCT-Z1-6	$38.80	$50.05	$61.30	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.75	$42.47	$51.20	
	1,001-2,000 work hours		$34.76	$43.99	$53.22	
	2,001-3,000 work hours		$35.77	$45.51	$55.24	
	3,001-4,000 work hours		$37.79	$48.53	$59.28	
Class VII - Restoration laborer, seeding, sodding, planting, cutting, mulching and topsoil grading and the restoration of property such as replacing mail boxes, wood chips, planter boxes and flagstones.		LAUCT-Z1-7	$32.08	$39.97	$47.86	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$28.71	$34.91	$41.12	
	1,001-2,000 work hours		$29.38	$35.92	$42.46	
	2,001-3,000 work hours		$30.06	$36.94	$43.82	
	3,001-4,000 work hours		$31.41	$38.97	$46.52	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Landscape Laborer						
	Landscape Specialist includes air, gas, and diesel equipment operator, skidsteer (or equivalent), lawn sprinkler installer on landscaping work where seeding, sodding, planting, cutting, trimming, backfilling, rough grading or maintenance of landscape projects occurs. Sundays paid at time & one half. Holidays paid at double time.	LLAN-Z1-A	$28.98	$40.04	$51.09	X X H X X X H D Y
	Skilled Landscape Laborer: small power tool operator, lawn sprinkler installers' tender, material mover, truck driver when seeding, sodding, planting, cutting, trimming, backfilling, rough grading or maintaining of landscape projects occurs Sundays paid at time & one half. Holidays paid at double time.	LLAN-Z1-B	$24.76	$33.71	$42.65	X X H X X X H D Y
Marble Finisher						
	Marble Finisher A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.	BR1-MF	$43.48	$54.29	$65.10	H H D H D D D D Y
	Apprentice Rates:					
	Level 1		$19.04	$25.12	$31.20	
	Level 2		$20.24	$26.92	$33.60	
	Level 3		$27.01	$33.96	$40.90	
	Level 4		$28.47	$36.14	$43.82	
	Level 5		$29.99	$37.84	$45.70	
	Level 6		$31.61	$39.86	$48.10	
	Level 7		$33.30	$41.59	$49.87	
	Level 8		$34.79	$43.48	$52.17	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Marble Mason						
Marble Mason	A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.	BR1-MM	$50.29	$64.51	$78.72	H H D H D D D D Y
		Apprentice Rates:				
		Level 1	$25.14	$32.65	$40.15	
		Level 2	$28.20	$36.49	$44.78	
		Level 3	$33.41	$41.97	$50.53	
		Level 4	$36.15	$45.66	$55.17	
		Level 5	$38.42	$48.17	$57.92	
		Level 6	$42.07	$53.56	$65.05	
		Level 7	$42.74	$54.38	$66.02	
		Level 8	$43.67	$55.78	$67.88	
Operating Engineer						
Crane with boom & jib or leads 120' or longer	Comment Double time after 12 hours M-F	EN-324-A120	$57.86	$75.50	$93.13	X X H H D D D D Y
Crane with boom & jib or leads 140' or longer	Work in excess of 12 per day M-F shall be paid at double time.	EN-324-A140	$58.68	$76.73	$94.77	X X H H D D D D Y
Crane with boom & jib or leads 220' or longer	Work in excess of 12 per day M-F shall be paid at double time.	EN-324-A220	$58.98	$77.18	$95.37	X X H H D D D D Y
Crane with boom & jib or leads 300' or longer	Work in excess of 12 per day M-F shall be paid at double time.	EN-324-A300	$60.48	$79.43	$98.37	X X H H D D D D Y
Crane with boom & jib or leads 400' or longer	Work in excess of 12 per day M-F shall be paid at double time.	EN-324-A400	$61.98	$81.68	$101.37	X X H H D D D D Y
Compressor or welding machine	Work in excess of 12 per day M-F shall be paid at double time.	EN-324-CW	$47.01	$59.22	$71.43	X X H H D D D D Y

Classification Name Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Forklift, lull, extend-a-boom forklift Work in excess of 12 per day M-F shall be paid at double time.	EN-324-FL	$54.32	$70.19	$86.05	X X H H D D D D Y
Fireman or oiler Work in excess of 12 per day M-F shall be paid at double time.	EN-324-FO	$45.98	$57.68	$69.37	X X H H D D D D Y
Regular crane, job mechanic, concrete pump with boom Work in excess of 12 per day M-F shall be paid at double time.	EN-324-RC	$57.00	$74.21	$91.41	X X H H D D D D Y
Regular engineer, hydro-excavator, remote controlled concrete breaker Work in excess of 12 per day M-F shall be paid at double time.	EN-324-RE	$56.03	$72.75	$89.47	X X H H D D D D Y
Apprentice Rates:					
0-999 hours		$45.00	$56.71	$68.41	
1,000-1,999 hours		$46.67	$59.22	$71.75	
2,000-2,999 hours		$48.78	$62.38	$75.97	
3,000-3,999 hours		$50.02	$64.24	$78.45	
4,000-4,999 hours		$51.69	$66.75	$81.79	
5,000-5,999 hours		$53.36	$69.24	$85.13	
Operating Engineer - DIVER					
Diver/Wet Tender/Tender/Rov Pilot/Rov Tender	GLF D	$52.80	$79.20	$105.60	H H H H H H H D N
Operating Engineer - Marine Construction					
Diver/Wet Tender, Engineer (hydraulic dredge) Holiday pay= $124.55 per hour, wages & fringes Make up day allowed *Subdivision of county* all Great Lakes, islands therein, & connecting & tributary waters	GLF-1	$65.00	$84.85	$104.70	X X H H H H H H D Y
Crane/Backhoe Operator, 70 ton or over Tug Operator, Mechanic/Welder, Assistant Engineer (hydraulic dredge), Leverman (hydraulic dredge), Diver Tender Holiday pay = $120.80 per hour, wages & fringes Make up day allowed *Subdivision of county* All Great Lakes, islands therein, & connecting & tributary waters	GLF-2	$63.50	$82.60	$101.70	X X H H H H H H D Y

Classification Name / Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Friction, Lattice Boom or Crane License Certification	GLF-2B	$64.50	$84.10	$103.70	X X H H H H H H D Y
Holiday pay = $123.30 Make up day allowed *Subdivision of county* All Great Lakes, islands, therein, & connecting & tributary waters					
Deck Equipment Operator, Machineryman, Maintenance of Crane (over 50 ton capacity) or Backhoe (115,000 lbs or more), Tug/Launch Operator, Loader, Dozer on Barge, Deck Machinery	GLF-3	$59.30	$76.30	$93.30	X X H H H H H H D Y
Holiday pay = $110.30 per hour, wages & fringes Make up day allowed *Subdivision of county* All Great Lakes, islands therein, & connecting & tributary waters					
Deck Equipment Operator, (Machineryman/Fireman), (4 equipment units or more), Off Road Trucks, Deck Hand, Tug Engineer, & Crane Maintenance 50 ton capacity and under or Backhoe 115,000 lbs or less, Assistant Tug Operator	GLF-4	$53.60	$67.75	$81.90	X X H H H H H H D Y
Holiday pay = $96.05 per hour, wages & fringes Make up day allowed *Subdivision of county* All Great Lakes, islands therein, & connecting & tributary waters					
Operating Engineer Steel Work					
Forklift, 1 Drum Hoist	EN-324-ef	$58.91	$77.25	$95.58	H H D H H H D D Y
Make up day allowed Comment 4 10s allowed M-Th with Friday makeup day because of bad weather					
Crane w/ 120' boom or longer	EN-324-SW120	$61.61	$81.30	$100.98	H H D H H H D D Y
Make up day allowed Comment 4 10s allowed M-Th with Friday makeup day because of bad weather					
Crane w/ 120' boom or longer w/ Oiler	EN-324-SW120-O	$62.61	$82.80	$102.98	H H D H H H D D Y
Make up day allowed Comment 4 10s allowed M-Th with Friday makeup day because of bad weather					
Crane w/ 140' boom or longer	EN-324-SW140	$62.79	$83.07	$103.34	H H D H H H D D Y
Make up day allowed Comment 4 10s allowed M-Th with Friday makeup day because of bad weather					
Crane w/ 140' boom or longer W/ Oiler	EN-324-SW140-O	$63.79	$84.57	$105.34	H H D H H H D D Y
Make up day allowed Comment 4 10s allowed M-Th with Friday makeup day because of bad weather					
Boom & Jib 220' or longer	EN-324-SW220	$63.06	$83.47	$103.88	H H D H H H D D Y
Make up day allowed Comment 4 10s allowed M-Th with Friday makeup day because of bad weather					

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Crane w/ 220' boom or longer w/ Oiler		EN-324-SW220-O	$64.06	$84.97	$105.88	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				
Boom & Jib 300' or longer		EN-324-SW300	$64.56	$85.72	$106.88	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				
Crane w/ 300' boom or longer w/ Oiler		EN-324-SW300-O	$65.56	$87.22	$108.88	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				
Boom & Jib 400' or longer		EN-324-SW400	$66.06	$87.97	$109.88	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				
Crane w/ 400' boom or longer w/ Oiler		EN-324-SW400-O	$67.06	$89.47	$111.88	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				
Crane Operator, Job Mechanic, 3 Drum Hoist & Excavator		EN-324-SWCO	$61.25	$80.76	$100.26	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				
	Apprentice Rates:					
	0-999 hours		$48.54	$62.19	$75.84	
	1,000-1,999 hours		$50.50	$65.13	$79.76	
	2,000-2,999 hours		$52.45	$68.06	$83.66	
	3,000-3,999 hours		$54.39	$70.96	$87.54	
	4,000-4,999 hours		$56.35	$73.91	$91.46	
	5,000 hours		$58.29	$76.82	$95.34	
Crane Operator w/ Oiler		EN-324-SWCO-O	$62.25	$82.26	$102.26	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				
Compressor or Welder Operator		EN-324-SWCW	$53.80	$69.58	$85.36	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				
Hoisting Operator, 2 Drum Hoist, & Rubber Tire Backhoe		EN-324-SWHO	$60.61	$79.80	$98.98	H H D H H H D D Y
Make up day allowed	Comment	4 10s allowed M-Th with Friday makeup day because of bad weather				

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Oiler		EN-324-SWO	$52.39	$67.47	$82.54	H H D H H H D D Y
Make up day allowed	Comment					
	4 10s allowed M-Th with Friday makeup day because of bad weather					
Tower Crane & Derrick where work is 50' or more above first level		EN-324-SWTD50	$62.34	$82.39	$102.44	H H D H H H D D Y
Make up day allowed	Comment					
	4 10s allowed M-Th with Friday makeup day because of bad weather					
Tower Crane & Derrick 50' or more w/ Oiler where work station is 50' or more above first level		EN-324-SWTD50-O	$63.34	$83.89	$104.44	H H D H H H D D Y
Make up day allowed	Comment					
	4 10s allowed M-Th with Friday makeup day because of bad weather					
Operating Engineer Underground						
Class I Equipment		EN-324A1-UC1	$53.14	$68.73	$84.32	H H H H H H H D Y
	Apprentice Rates:					
	0-999 hours		$42.99	$53.91	$64.82	
	1,000-1,999 hours		$44.54	$56.24	$67.92	
	2,000-2,999 hours		$46.10	$58.58	$71.04	
	3,000-3,999 hours		$47.66	$60.91	$74.16	
	4,000-4,999 hours		$49.22	$63.25	$77.28	
	5,000-5,999 hours		$50.77	$65.57	$80.38	
Class II Equipment		EN-324A1-UC2	$48.41	$61.64	$74.86	H H H H H H H D Y
Class III Equipment		EN-324A1-UC3	$47.68	$60.54	$73.40	H H H H H H H D Y
Class IV Equipment		EN-324A1-UC4	$47.11	$59.69	$72.26	H H H H H H H D Y
Master Mechanic		EN-324A1-UMM	$53.39	$69.56	$85.73	H H H H H H H D Y

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Painter						
Painter (8 hours of repaint work performed on Sunday shall be paid time & one half rate) Four 10s allowed Monday-Thursday with Friday makeup day if job down due to weather, holiday or other conditions beyond the control of the employer. Make up day allowed Comment Fridays for bad weather or holidays		PT-22-P	$43.57	$56.60	$69.63	H H D H D D D D Y
	Apprentice Rates:					
	First 6 months		$30.54	$37.05	$43.57	
	Second 6 months		$34.45	$42.92	$51.39	
	Third 6 months		$35.75	$44.87	$53.99	
	Fourth 6 months		$37.06	$46.83	$56.61	
	Fifth 6 months		$38.36	$48.79	$59.21	
	Final 6 months		$39.66	$50.73	$61.81	
Pipe and Manhole Rehab						
General Laborer for rehab work or normal cleaning and cctv work-top man, scaffold man, CCTV assistant, jetter-vac assistant		TM247	$28.20	$38.20		H H H H H H H H N
Tap cutter/CCTV Tech/Grout Equipment Operator: unit driver and operator of CCTV; grouting equipment and tap cutting equipment		TM247-2	$32.70	$44.95		H H H H H H H H N
CCTV Technician/Combo Unit Operator: unit driver and operator of cctv unit or combo unit in connection with normal cleaning and televising work		TM247-3	$31.45	$43.07		H H H H H H H H N
Boiler Operator: unit driver and operator of steam/water heater units and all ancillary equipment associated		TM247-4	$33.20	$45.70		H H H H H H H H N
Combo Unit driver & Jetter-Vac Operator		TM247-5	$33.20	$45.70		H H H H H H H H N
Pipe Bursting & Slip-lining Equipment Operator		TM247-6	$34.20	$47.20		H H H H H H H H N

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Pipefitter						
Pipefitter		PF-636	$67.83	$89.03	$106.23	H H D H D D D D Y
	Comment Four 10s allowed during the week preceding, following and/or the week of a holiday.					
		Apprentice Rates:				
		1st & 2nd periods	$26.93	$35.28	$42.28	
		3rd period	$28.93	$38.28	$46.28	
		4th period	$30.18	$40.16	$48.78	
		5th period	$31.43	$42.03	$51.28	
		6th period	$32.68	$43.90	$53.78	
		7th period	$33.93	$45.78	$56.28	
		8th period	$34.93	$47.28	$58.28	
		9th period	$35.93	$48.78	$60.28	
		10th period	$37.36	$50.92	$63.14	
Plasterer						
Plasterer		BR1P	$45.04	$67.56	$90.08	H H H H H H H D N
Make up day allowed	Comment Saturday					
		Apprentice Rates:				
		1st 6 months	$32.11	$48.17	$64.22	
		2nd 6 months	$33.40	$50.10	$66.80	
		3rd 6 months	$34.69	$52.04	$69.38	
		4th 6 months	$37.28	$55.92	$74.56	
		5th 6 months	$39.87	$59.81	$79.74	
		6th 6 months	$42.45	$63.68	$84.90	
Plasterer		PL67	$44.72	$60.11	$75.50	H H H X D D D D N
		Apprentice Rates:				
		1st 6 months	$29.33	$37.02	$44.72	
		2nd 6 months	$30.87	$39.34	$47.80	
		3rd 6 months	$32.41	$41.64	$50.88	
		4th 6 months	$35.49	$46.26	$57.04	
		5th 6 months	$38.56	$51.16	$63.76	
		6th 6 months	$41.64	$55.49	$69.34	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Plumber						
Plumber		PL-98	$64.45	$84.87	$101.29	H H D H D D D D Y
	Comment 4 tens allowed M-Th or T-F; OT of time and one half required on 11th & 12th hour of any ten hour days					
		Apprentice Rates:				
		Period 1	$19.93	$26.43	$32.93	
		Period 2	$23.90	$31.40	$38.90	
		Period 3	$30.60	$39.19	$47.77	
		Period 4	$31.23	$40.13	$49.03	
		Period 5	$32.39	$41.87	$51.35	
		Period 6	$33.54	$43.59	$53.65	
		Period 7	$34.69	$45.32	$55.95	
		Period 8	$35.86	$47.07	$58.29	
		Period 9	$37.01	$48.80	$60.59	
		Period 10	$38.16	$50.53	$62.89	
Roofer						
Commercial Roofer Straight time is not to exceed ten (10) hours per day or forty (40) hours per week.		RO-149-WOM	$48.46	$62.29	$76.62	H H D H H H D D N
Make up day allowed						
		Apprentice Rates:				
		Apprentice 1	$32.62	$39.86	$48.04	
		Apprentice 2	$36.80	$44.80	$53.30	
		Apprentice 3	$38.22	$46.93	$56.14	
		Apprentice 4	$39.25	$48.48	$58.20	
		Apprentice 5	$40.47	$50.30	$60.64	
		Apprentice 6	$41.87	$52.40	$63.44	
Sewer Relining						
Class I-Operator of audio visual CCTV system including remote in-ground cutter and other equipment used in conjunction with CCTV system.		SR-I	$43.66	$59.01	$74.36	H H H H H H H D N
Class II-Operator of hot water heaters and circulation system; water jetters; and vacuum and mechanical debris removal systems and those assisting.		SR-II	$42.13	$56.72	$71.30	H H H H H H H D N

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Sheet Metal Worker						
Sheet Metal Worker	A 4 10 schedule may be worked, 4 consecutive days Monday thru Friday.	SHM-80	$63.15	$80.53	$97.90	H H D X H H H D Y
		Apprentice Rates:				
		1st & 2nd Periods Indentured after 6-1-11	$39.99	$47.82	$55.63	
		3rd & 4th Periods Indentured after 6-1-11	$41.73	$50.42	$59.11	
		5th & 6th Periods Indentured after 6-1-11	$43.46	$53.02	$62.57	
		7th & 8th Periods Indentured after 6-1-11	$45.21	$55.64	$66.07	
Siding and decking	Make up day allowed	SHM-80-SD	$42.07	$54.28	$66.48	H H H H H H H D Y
Sprinkler Fitter						
Sprinkler Fitter	4 ten hour days allowed Monday-Friday Double time pay due after 12 hours worked M-F	SP 704	$65.82	$87.20	$108.58	H H D H D D D D Y
		Apprentice Rates:				
		1st Period	$40.16	$48.71	$57.26	
		2nd Period	$42.30	$51.92	$61.54	
		3rd Period	$44.44	$55.13	$65.82	
		4th Period	$46.58	$58.34	$70.10	
		5th Period	$48.72	$61.55	$74.38	
		6th Period	$50.85	$64.74	$78.64	
		7th Period	$52.99	$67.96	$82.92	
		8th Period	$55.13	$71.16	$87.20	
		9th Period	$57.27	$74.38	$91.48	
		10th Period	$59.41	$77.58	$95.76	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Terrazzo						
Terrazzo Finisher	A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.	BR1-TRF	$43.97	$55.03	$66.08	H H D H D D D D Y
		Apprentice Rates:				
		Level 1	$19.04	$25.12	$31.20	
		Level 2	$20.24	$26.92	$33.60	
		Level 3	$27.01	$33.96	$40.90	
		Level 4	$28.47	$36.14	$43.82	
		Level 5	$29.99	$37.84	$45.70	
		Level 6	$31.61	$39.86	$48.10	
		Level 7	$33.30	$41.59	$49.87	
		Level 8	$34.79	$43.48	$52.17	
Terrazzo Worker	A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.	BR1-TRW	$49.73	$63.67	$77.60	H H D H D D D D Y
		Apprentice Rates:				
		Level 1	$25.14	$32.65	$40.15	
		Level 2	$28.20	$36.49	$44.78	
		Level 3	$33.41	$41.97	$50.53	
		Level 4	$36.15	$45.66	$55.17	
		Level 5	$38.42	$48.17	$57.92	
		Level 6	$42.07	$53.56	$65.05	
		Level 7	$42.74	$54.38	$66.02	
		Level 8	$43.67	$55.78	$67.88	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Tile						
Tile Finisher	A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.	BR1-TF	$43.50	$54.32	$65.14	H H D H D D D D Y
		Apprentice Rates:				
		Level 1	$19.04	$25.12	$31.20	
		Level 2	$20.24	$26.92	$33.60	
		Level 3	$27.01	$33.96	$40.90	
		Level 4	$28.47	$36.14	$43.82	
		Level 5	$29.99	$37.84	$45.70	
		Level 6	$31.61	$39.86	$48.10	
		Level 7	$33.30	$41.59	$49.87	
		Level 8	$34.79	$43.48	$52.17	
Tile Layer	A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.	BR1-TL	$49.68	$63.59	$77.50	H H D H D D D D Y
		Apprentice Rates:				
		Level 1	$25.14	$32.65	$40.15	
		Level 2	$28.20	$36.49	$44.78	
		Level 3	$33.41	$41.97	$50.53	
		Level 4	$36.15	$45.66	$55.17	
		Level 5	$38.42	$48.17	$57.92	
		Level 6	$42.07	$53.56	$65.05	
		Level 7	$42.74	$54.38	$66.02	
		Level 8	$43.67	$55.78	$67.88	
Truck Driver						
on all trucks of 8 cubic yard capacity or less (except dump trucks of 8 cubic yard capacity or over, tandem axle trucks, transit mix and semis, euclid type equipment, double bottoms and low boys)		TM-RB1	$41.92	$37.85		H H H H H H H H Y
of all trucks of 8 cubic yard capacity or over		TM-RB1A	$41.30	$38.00		H H H H H H H H Y
on euclid type equipment		TM-RB1B	$41.45	$38.23		H H H H H H H H Y
Make up day allowed						

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Underground Laborer Open Cut, Class I						
Construction Laborer		LAUC-Z1-1	$37.72	$48.43	$59.14	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$32.94	$41.26	$49.58	
	1,001-2,000 work hours		$33.90	$42.70	$51.50	
	2,001-3,000 work hours		$34.85	$44.13	$53.40	
	3,001-4,000 work hours		$36.76	$46.99	$57.22	
Underground Laborer Open Cut, Class II						
Mortar and material mixer, concrete form man, signal man, well point man, manhole, headwall and catch basin builder, guard rail builders, headwall, seawall, breakwall, dock builder and fence erector.		LAUC-Z1-2	$37.83	$48.60	$59.36	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.02	$41.38	$49.74	
	1,001-2,000 work hours		$33.98	$42.82	$51.66	
	2,001-3,000 work hours		$34.95	$44.27	$53.60	
	3,001-4,000 work hours		$36.87	$47.15	$57.44	
Underground Laborer Open Cut, Class III						
Air, gasoline and electric tool operator, vibrator operator, drillers, pump man, tar kettle operator, bracers, rodder, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars, etc.), cement finisher, welder, pipe jacking and boring man, wagon drill and air track operator and concrete saw operator (under 40 h.p.), windlass and tugger man, and directional boring man.		LAUC-Z1-3	$37.88	$48.67	$59.46	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.06	$41.44	$49.82	
	1,001-2,000 work hours		$34.02	$42.88	$51.74	
	2,001-3,000 work hours		$34.99	$44.33	$53.68	
	3,001-4,000 work hours		$36.92	$47.23	$57.54	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Underground Laborer Open Cut, Class IV						
Trench or excavating grade man.		LAUC-Z1-4	$37.96	$48.79	$59.62	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.12	$41.53	$49.94	
	1,001-2,000 work hours		$34.09	$42.99	$51.88	
	2,001-3,000 work hours		$35.06	$44.44	$53.82	
	3,001-4,000 work hours		$36.99	$47.33	$57.68	
Underground Laborer Open Cut, Class V						
Pipe Layer		LAUC-Z1-5	$38.02	$48.88	$59.74	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$33.16	$41.59	$50.02	
	1,001-2,000 work hours		$34.14	$43.06	$51.98	
	2,001-3,000 work hours		$35.11	$44.51	$53.92	
	3,001-4,000 work hours		$37.05	$47.43	$57.80	
Underground Laborer Open Cut, Class VI						
Grouting man, top man assistant, audio visual television operations and all other operations in connection with closed circuit television inspection, pipe cleaning and pipe relining work and the installation and repair of water service pipe and appurtenances.		LAUC-Z1-6	$35.47	$45.06	$54.64	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$31.25	$38.73	$46.20	
	1,001-2,000 work hours		$32.10	$40.00	$47.90	
	2,001-3,000 work hours		$32.94	$41.26	$49.58	
	3,001-4,000 work hours		$34.63	$43.79	$52.96	

Classification Name	Description		Straight Hourly	Time and a Half	Double Time	Overtime Provision
Underground Laborer Open Cut, Class VII						
Restoration laborer, seeding, sodding, planting, cutting, mulching and topsoil grading and the restoration of property such as replacing mail boxes, wood chips, planter boxes, flagstones etc.		LAUC-Z1-7	$32.09	$39.99	$47.88	X X X X X X X D Y
	Apprentice Rates:					
	0-1,000 work hours		$28.72	$34.93	$41.14	
	1,001-2,000 work hours		$29.39	$35.93	$42.48	
	2,001-3,000 work hours		$30.07	$36.95	$43.84	
	3,001-4,000 work hours		$31.42	$38.98	$46.54	

CONTRACTOR'S QUALIFICATION STATEMENT FOR GENERAL CONTRACTORS

CITY OF WARREN
Dorothy M. Busch Library Project

INSTRUCTIONS AND PROCEDURES

All Bidders must submit with their bid, a completed AIA A305-1986 Contractor's Qualification Statement, as modified below and containing the additional requested information.

A. GENERAL INFORMATION. The City of Warren is requesting qualifications from interested General Contractors that are submitting a bid for the construction of the Dorothy M. Busch Library, located at 23333 Ryan Road, Warren, MI 48091.

The completed Contractor's Qualification Statements will be evaluated by The City of Warren in conjunction with the submitted bids to determine the lowest responsible bid.

B. MINIMUM QUALIFICATION CRITERIA. Prospective bidders shall have the following minimum qualifications.

1. The Contractor shall have been in business under the present company name for a minimum of ten (10) years and shall not have been declared in default on any construction contract within that time or have any pending judgements.
2. The Contractor shall have completed at least three (3) municipal / governmental projects (similar to the proposed project) having a construction value of at least $1,000,000 within the last ten (10) years.
3. The Contractor shall have demonstrated abilities and documented processes to effectively manage a construction project, maintain a construction schedule and expeditiously close out a project.
4. The Contractor shall be able to provide a 100% payment and performance bond for the project and must be able to provide the specified insurances.

C. CONTRACTOR'S QUALIFICATION STATEMENT. Contractor shall submit a completed AIA A305-1986 Contractor's Qualification Statement, with the modifications and additions as follows:

1. Add Paragraph 3.2.4: Submit a copy of all lawsuits to the City in duplicate.

2. Revise Paragraph 3.4 to read: On a separate sheet, list all of your construction projects your organization has in progress, giving the name of the project, owner, owner's contact name and phone number, architect, architect's contact name and phone number, initial contract amount, change order costs to date, scheduled and anticipated completion dates and percentage of the work being performed with your own forces.

3. Revise Paragraph 3.5 to read: On a separate sheet, list all of your municipal / institutional projects (over $1,000,000) completed in the past five years, giving the name of the project, owner, owner's contact name and phone number, architect, architect's contact name and phone number, initial and final contract amounts, scheduled and actual completion dates and percentage of the work performed with your own forces. In addition to the municipal / institutional projects listed, provide a list of other projects completed in the past five years; also include a total construction value completed per year.

4. Revise Paragraph 3.6 to read: Include resumes of specific personnel likely to be assigned to this project for the roles of: principal, project manager, project engineer and construction site superintendent. Provide relevant project experience of each individual as well as their current workloads (commitments for other projects). Provide a detailed description of their role for this project, include indications of time commitment (ie: full time, ½ time, etc.)

5. Add Paragraph 3.7: On a separate sheet, provide a description of your scheduling system and project management approach. Include the following information (as a minimum):

   3.7 Scheduling / Project Management
   - 3.7.1 Description of computer based scheduling program.
   - 3.7.2 Type of reports generated (CPM, Bar chart, etc.).
   - 3.7.3 Names and titles of individuals in firm proficient in its use.
   - 3.7.4 Statement on how the system is used in house to support project management including: what reports are generated, who initiates reports, who receives reports, how reports are used, how reports are updated, frequency of updates, etc.
   - 3.7.5 Provide a specific project management plan and milestone schedule for this project. Provide enough detail to convey your understanding of the project as well as how you will deliver a successful project.

6. Add Paragraph 3.8: Explain why your Company is best suited for this project.

7. Paragraph 4.2: Include Bank Officer contact name and telephone number.

8. Paragraph 4.3: Add the following sub paragraph:

   4.3.3 Maximum bonding capacity.
   a. Maximum total value of contract work $_____.
   b. Maximum value for a single project $_____.

D. EVALUATION

1. Process. Firms submitting their bids and Contractor's Qualification Statement will be evaluated by the City of Warren as well as their Architect. The evaluation will be based on the information provided in the firm's submission as well as any other information the City or the Architect obtains concerning the firm's past performance. Oral interviews may be required to assist the City and Architect in their evaluation.

   Firms which have submitted incomplete information may be provided an opportunity to correct any deficiencies which is at the sole discretion of the City. The City will notify the contractor in writing indicating the specific items which need to be addressed in order to be considered for this project.

2. The City expressly reserves the right to reject any and all bids, including the bid of any contractor that is not reasonably determined to be "responsible" in conjunction with the submitted information or the Responsibility Criteria outlined below. The City may consider the following information in determining whether a contractor is a Responsible Contractor. This is not intended to be an all-inclusive or exhaustive list.

RESPONSIBILTY CRITERIA

1. General information about the contractor's company, its principals, and its history, including state, date of formation and type of legal entity which the contractor utilizes to perform its business.

2. Evidence that the contractor and its employee(s) are appropriately licensed and are certified to perform the work that has been bid.

3. A confirmation that all subcontractors, employees and other individuals working on the Construction Project will maintain current applicable licenses and certifications with all appropriate licensing agencies including the Michigan Bureau of Construction Codes and Fire Safety, or any successor agency, and as may otherwise be required by law for all licensed occupations and professions.

4. The ratio of masters to journeypersons to apprentices proposed to be used on the Construction Project job site.

5. A description of any apprenticeship-training program maintained by the contractor.

6. Documentation that contractor has implemented a MIOSHA-approved safety/training program for employees used on the proposed job site.

7. A detailed description of the warranty statement covering labor and materials, which will be provided by the contractor if it is awarded the contract.

8. A list of any and all litigation or arbitrations involving the contractor within the past five (5) years, including an explanation of the circumstances surrounding the dispute, the remedy sought, and how the dispute was resolved or, if pending, the status of the litigation or arbitration.

9. Evidence of insurance, including certificates of insurance, confirming existence and amount of coverage for liability, property damage, workers compensation, and any other insurances required by the proposed contract documents, if it is awarded the contract.

10. References from individuals or entities that have received in the past five (5) years, or that are currently receiving, the contractor's services, including information regarding records of performance and job site cooperation.

11. A detailed description of any quality assurance program used by the contractor.

12. Evidence of the existence of a drug and alcohol program which will prevent all of the contractor's employees from entering City property under the influence of drugs or alcohol for each employee that will be working on the job site.

13. Evidence of the existence of a criminal records check procedure for each employee that will be working on the job site.

14. Any other relevant expertise, equipment, or ability of the contractor to perform the Construction Project, or relevant portion thereof.

END OF SECTION 003111

AIA® Document A305™ – 1986

Contractor's Qualification Statement

The Undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading.

SUBMITTED TO:

ADDRESS:

SUBMITTED BY:

NAME:

ADDRESS:

PRINCIPAL OFFICE:

[ ] Corporation
[ ] Partnership
[ ] Individual
[ ] Joint Venture
[ ] Other

NAME OF PROJECT: *(if applicable)* Misc

TYPE OF WORK: *(file separate form for each Classification of Work)*

[ ] General Construction
[ ] HVAC
[ ] Electrical
[ ] Plumbing
[ ] Other: *(Specify)*

§ 1 ORGANIZATION

§ 1.1 How many years has your organization been in business as a Contractor?

§ 1.2 How many years has your organization been in business under its present business name?

§ 1.2.1 Under what other or former names has your organization operated?

§ 1.3 If your organization is a corporation, answer the following:

§ 1.3.1 Date of incorporation:

§ 1.3.2 State of incorporation:

§ 1.3.3 President's name:

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This form is approved and recommended by the American Institute of Architects (AIA) and The Associated General Contractors of America (AGC) for use in evaluating the qualifications of contractors. No endorsement of the submitting party or verification of the information is made by AIA or AGC.

§ **1.3.4** Vice-president's name(s)

§ **1.3.5** Secretary's name:

§ **1.3.6** Treasurer's name:

§ **1.4** If your organization is a partnership, answer the following:

§ **1.4.1** Date of organization:

§ **1.4.2** Type of partnership (if applicable):

§ **1.4.3** Name(s) of general partner(s)

§ **1.5** If your organization is individually owned, answer the following:

§ **1.5.1** Date of organization:

§ **1.5.2** Name of owner:

§ **1.6** If the form of your organization is other than those listed above, describe it and name the principals:

§ 2 LICENSING

§ **2.1** List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

§ **2.2** List jurisdictions in which your organization's partnership or trade name is filed.

§ 3 EXPERIENCE

§ **3.1** List the categories of work that your organization normally performs with its own forces.

§ **3.2** Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)

§ **3.2.1** Has your organization ever failed to complete any work awarded to it?

§ **3.2.2** Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

§ **3.2.3** Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years?

§ **3.3** Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

§ 3.4 On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

§ 3.4.1 State total worth of work in progress and under contract:

§ 3.5 On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

§ 3.5.1 State average annual amount of construction work performed during the past five years:

§ 3.6 On a separate sheet, list the construction experience and present commitments of the key individuals of your organization.

§ 4 REFERENCES

§ 4.1 Trade References:

§ 4.2 Bank References:

§ 4.3 Surety:

§ 4.3.1 Name of bonding company:

§ 4.3.2 Name and address of agent:

§ 5 FINANCING

§ 5.1 Financial Statement.

§ 5.1.1 Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);

Net Fixed Assets;

Other Assets;

Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);

Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

§ 5.1.2 Name and address of firm preparing attached financial statement, and date thereof:

§ 5.1.3 Is the attached financial statement for the identical organization named on page one?

§ 5.1.4 If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

§ 5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

§ 6 SIGNATURE

§ 6.1 Dated at this day of

Name of Organization:

By:

Title:

§ 6.2

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

Subscribed and sworn before me this day of

Notary Public:

My Commission Expires:

DOCUMENT 003119 - EXISTING CONDITION INFORMATION

1.1 EXISTING CONDITION INFORMATION

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

B. Existing drawings that include information on existing conditions including previous construction at Project site are available for viewing on the Owner's Bid Procurement website (MITN).

C. Survey information that includes information on existing conditions, prepared by Great Lakes Geomatics, dated November 30, 2015 is available for viewing as part of Drawings.

D. Photographic report of existing conditions that includes photographic documentation on existing conditions, prepared by PARTNERS in Architecture, PLC is available for viewing as part of Drawings.

E. Related Requirements:

1. AIA Document A701 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
2. Document 003126 "Existing Hazardous Material Information" for hazardous materials reports that are made available to bidders.
3. Document 003132 "Geotechnical Data" for reports and soil-boring data from geotechnical investigations that are made available to bidders.

END OF DOCUMENT 003119

DOCUMENT 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

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

B. An existing asbestos, lead and PCB report for Project, prepared by NTH Consultants, Ltd., dated June 10, 2013, is available for viewing on the Owner’s Bid Procurement Website (MITN).

C. Related Requirements:

1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
2. Document 003119 "Existing Condition Information" for information about existing conditions that is made available to bidders.
3. Document 003132 "Geotechnical Data" for reports and soil-boring data from geotechnical investigations that are made available to bidders.
4. Section 024116 "Structure Demolition"" for notification requirements if materials suspected of containing hazardous materials are encountered.

END OF DOCUMENT 003126

DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

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

B. A geotechnical investigation report for Project, prepared by Testing Engineers and Consultants, Inc., dated November 30, 2015, is available for viewing as appended to this Document.

C. Related Requirements:

1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
2. Document 003119 "Existing Condition Information" for information about existing conditions that is made available to bidders.
3. Document 003126 "Existing Hazardous Material Information" for hazardous materials reports that are made available to bidders.

END OF DOCUMENT 003132

City of Warren
One City Square
Warren, Michigan 48043

GEOTECHNICAL INVESTIGATION

FOR

Dorothy Busch Branch Library Reconstruction
23333 Ryan Road
Warren, Michigan

TEC Report: 56195

By:

Testing Engineers & Consultants, Inc.
1343 Rochester Road
P.O. Box 249
Troy, Michigan 48099-0249
(248) 588-6200

November 30, 2015

Testing Engineers & Consultants, Inc.
1343 Rochester Road • PO Box 249 • Troy, Michigan 48099-0249
(248) 588-6200 or (313) T-E-S-T-I-N-G • Fax (248) 588-6232
www.testingengineers.com

TEC Report: 56195
Date Issued: November 30, 2015

Ms. Oksana Urban
City of Warren
One City Square
Warren, Michigan 48043

Re: Geotechnical Investigation for
Dorothy Busch Branch Library Reconstruction
23333 Ryan Road
Warren, Michigan

Dear Ms. Urban:

Please find enclosed the results of a geotechnical investigation performed at the above referenced site. This geotechnical report presents our field and laboratory results; engineering analysis; and our recommendations for design of foundation, as well as important construction considerations.

As you may know, Testing Engineers & Consultants, Inc. (TEC) has more than forty nine years of experience in Quality Control Testing and Construction Inspection. We would be pleased to provide these services on this project.

Should you have any questions regarding this report, please let us know. It has been a pleasure to be of service to you.

Respectfully submitted,

TESTING ENGINEERS & CONSULTANTS, INC.

Carey J. Suhan, P.E.,
Vice President, Geotechnical
& Environmental Services

CJS/ln
Enclosure
cc: Partners In Architecture, PLC, Attn: Mr. Michael Malone

Ms. Oksana Urban
City of Warren
November 30, 2015

TEC Report: 56195

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APPENDIX

Ms. Oksana Urban
City of Warren
November 30, 2015

TEC Report: 56195

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed building reconstruction and parking lot addition at 23333 Ryan Road in Warren, Michigan. Authorization to perform this investigation was given by Ms. Oksana Urban, Library Director on October 21, 2015 and in accordance with TEC Proposal No. 060-15-0201.

The proposed development is to consist of the reconstruction of a single story slab on grade branch library building. The footprint of the reconstructed building will increase from 4,500 square feet to 6,500 square feet. The existing parking lots will be realigned and expanded to the south to accommodate the new building. A 1 ½ story home with basement and a small garage on the south side will be demolished for the parking expansion. The new building will house a community room, meeting room and handicapped accessible restrooms.

The purpose of this investigation was to obtain information necessary to determine basic engineering properties of soils at the site through a series of test borings and laboratory tests performed on the soil samples obtained during the field investigation. This information has been evaluated to provide the general recommendations for site development preparations, foundation requirements, pavement rehabilitation and other relevant geotechnical information.

2.0 FIELD INVESTIGATION

Ten test borings were drilled on the site at the locations shown on the Test Boring Location Plan. The borings are numbered 1 through 10. The locations are accurate to within a short distance of the locations shown on the plan. The test borings were drilled on October 27, 2015 and November 9, 2015 with auger equipment mounted on a truck to depths of 20 feet.

Drilling methods and standard penetration tests were performed in general accordance with the current ASTM D-1452 and D-1586 procedures, respectively. These procedures specify that a standard 2-inch O.D. split-barrel sampler be driven by a 140-pound hammer with a free fall of 30 inches. The number of hammer blows required to drive the split-barrel sampler through three successive 6-inch increments is recorded on the Test Boring Log. The first 6-inch increment is used for setting the sampler firmly in the soil and the sum of the hammer blows for the second and third increments is referred to as the "Standard Penetration Index" (N). N values were obtained with an automatic trip hammer.

From the standard penetration test a soil sample is recovered in the liner sampler tubes that are located inside the split-barrel sampler. Upon recovery of a soil sample, the liner tubes are removed from the split-barrel sampler and placed in a container which is sealed to minimize moisture losses during transportation to the laboratory. Standard penetration tests are usually made at depths of 2 ½, 5, 7 ½ and 10 feet and at 5-foot depth intervals thereafter. These parameters may vary for a given project depending on the nature of the subsoils and the geotechnical information required.

3.0 LABORATORY TESTING

The laboratory testing consisted of determining the unconfined compressive strength, the natural bulk density and the natural moisture content of the soil samples recovered in the liner sampler tubes. In the unconfined compression tests, the compressive strength of the soil is determined by axially loading a soil sample until failure is observed or 15% strain, whichever occurs first. The above referenced test data are recorded on the boring logs. Some test results may deviate from the norm because of variations in texture, imperfect samples, presence of pebbles and/or sand streaks, etc. The results are still reported although they may not be relevant.

In addition to the above tests, the particle size distribution of two granular soil samples were also determined. The particle size distribution provides soil classification, structural support information and an estimate of permeability-related behavior of the granular soil. One sample tested was taken directly below the asphalt pavement. The material present was found not to satisfy the requirements of 21AA specifications. The results are included in the appendix.

In addition, Loss on Ignition tests were conducted on two samples to determine the organic content. The results are included on Boring Log Nos. 2 and 7 in the appendix.

The laboratory test results apply to the samples tested and some results may not be representative of the soil mass because of variations in composition and texture, as well as imperfect samples and presence of pebbles and/or sand streaks in cohesive samples, etc.

Samples taken in the field are retained in our laboratory for 60 days and are then destroyed unless special disposition is requested by the client. Samples retained over a long period of time are subject to moisture loss and are then no longer representative of the conditions initially encountered.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 Subsoil Conditions

The borings were drilled around the perimeter of the existing library building (Boring Nos. 4 through 7), in the area of the existing parking lot (Boring Nos. 1 through 3) and in the general vicinity if the building to be demolished (Boring Nos. 8 through 10).

The soil conditions encountered in the borings are presented on the individual boring logs. Each log presents the soil types encountered at that location as well as laboratory test data, ground water data, and other pertinent information. Descriptions of the various soil consistencies, relative densities and particle sizes are given in the Appendix. Definitions of the terms and symbols utilized in this report may be found in ASTM D-653.

4.1 Subsoil Conditions (Cont'd)

Soil descriptions and depths shown on the borings are approximate indications of change from one soil type to another and are not intended to represent an area of exact geological change or stratification.

The subsurface conditions encountered in the borings may be generalized as follows for purpose of analysis. Please refer to the limitations (Appendix A) regarding the uncertainties involved in such a generalization.

The soil strata encountered are presented below:

Topsoil

Vegetation and sandy topsoil was encountered in seven of the ten borings. The thickness of the topsoil was found to vary from 4" (Boring No. 4) to 1.5' (Boring No. 5). The topsoil consists of dark brown sand. Also a layer of dark brown sand and topsoil was encountered in Boring No. 1 extending to a depth of 3'.

Asphalt Pavement

The hot mix asphalt (HMA) layer was encountered in three borings (Nos. 1 through 3). The thickness of this layer was found to be 3 ½". The surface of the asphalt was generally in poor condition. In Boring No. 2 a 5 ½" thick layer of concrete was present below the asphalt. In Boring Nos. 1 and 3 a layer of granular base 8 ½" was found. The granular base is finer than the gradation of 21AA.

Fill

Fill was encountered in Boring No. 7 extending to a depth of 4'. The fill consists of brown medium compact sand.

Native Sand

The native sand deposit consists of brown medium to fine sand. The upper sand deposit consists of dark brown sand to a depth of 3' in Boring Nos. 1 through 4. In Boring No. 7 a 1.5' thick layer of dark gray clayey sand with some silt and trace of organics was found below the fill.

Standard penetration values range from 3 to 17 blows per foot. Bulk densities range from 111 to 133 pounds per cubic foot (pcf) with moisture contents of 2.2 to 18.1 percent of the dry weight of the soil.

4.1 Subsoil Conditions (Cont'd)

Gray Clay With Some Silt

The underlying native deposits consist of layers of plastic to stiff gray clay. The clays start at depths ranging from 5.5 to 6 feet below existing grade and extend to the terminal depth of the borings.

Standard penetration values range from 7 blows per foot to 22 blows for a penetration of 1 foot with unconfined compressive strengths of 1980 to 7910 pounds per square foot (psf). Bulk densities range from 118 to 140 pounds per cubic foot with moisture contents of 11.3 to 28 percent of the dry weight of the soil.

4.2 Ground Water Observations

Water level readings were taken in the bore holes during and after the completion of drilling in Boring Nos. 1 through 6 and 8. These observations are noted on the respective Test Boring Logs. Ground water was first encountered during drilling in the borings at depths ranging from 3' to 13' below existing ground surface. After completion of drilling and removal of the augers, water was measured at depths ranging from 4' to 18'. Boring Nos. 1 and 8 caved in at 8'3" and 4'4", respectively while in Boring Nos. 7, 9 and 10 no water was encountered.

5.0 ANALYSIS AND RECOMMENDATIONS

5.1 Ground Water Conditions

The position of water levels found in test borings may vary somewhat depending on seasonal precipitation. At the level encountered in the borings, it will present some problems for any excavation below a depth of 3'. Construction of foundations for the addition, if constructed at shallow depth will likely encounter some water issues which could be handled with normal dewatering procedures. We expect that the ground water should be controllable by pumping from properly prepared sumps. Dewatering should begin prior to foundation excavation. However, lowering the water table could cause settlement of the existing library building foundations. The existing building should be monitored with survey points during foundation construction. We anticipate that utilities are already constructed.

With any addition, some differential settlement between the existing and new construction should be expected, since the existing building is primarily done settling and the new addition will settle. We recommend that a construction joint be constructed between the existing and new structure.

5.2 Recommended Earthwork Operations

Within the limits of areas to be developed, the surface vegetation, topsoil and any unsuitable soils should be removed prior to the site being graded. All existing foundations from the house and garage should be removed. The basement slab could be left in place but sufficiently broken or perforated to allow drainage and minimize trapping water at the backfill and slab interface. The fill present in Boring No. 7 to a depth of 4' was found to be medium compact. This material should be suitable to remain in place below floor slabs.

Engineered backfill required for construction excavations or fill required to achieve desired grades should preferably consist of clean and well graded granular soils. The on-site clayey sands, with high clay contents should not be used as engineered fill directly under slabs and pavements or as backfill in utility trenches or against foundations. They should only be used in mass grading operations for balancing and grading the site. Fill should be placed in uniform layers not more than 9 inches in thickness with the soils in each layer compacted to a minimum of 95% of the maximum density as determined by ASTM D-1557. Fill should be at approximately the optimum moisture content during placement and compaction. Furthermore, frozen material must not be used as fill and fill should not be placed on frozen ground. It is imperative that the backfill of the former basement be properly placed and compacted under continuous density monitoring.

Since the upper granular soils are predominantly loose to medium compact sands and clayey sands, lateral support structures or side sloping with a minimum 1H:1V ratio will be required for the anticipated excavations. Care must be exercised when excavating next to existing foundations to avoid undermining the existing foundations. Preferably new foundations should be placed at the same elevation as adjacent existing foundations. Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in conditions such as from disturbances, rain or freezing. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, all footing concrete should be placed the same day the excavation is made. If this is not possible, the footing excavations should be adequately protected.

5.3 Foundation Recommendations

The present plan for the addition is to construct the enlarged building around the existing building. The granular soils present to depths up to 5.5' in the addition areas vary from loose to medium compact sands. It is suggested that the loose sands be compacted prior to any foundation construction. Extreme care should be taken to avoid causing settlements to existing foundations during densification of the loose sands.

Shallow Foundations

Local building codes and climatic conditions require that exterior shallow footings be based at a minimum depth of 3 ½ feet below finished grade for adequate frost protection.

5.3 Foundation Recommendations (Cont'd)

The foundations should bear on the native sandy deposits found below any existing fill at depths ranging from 1' to 3' below existing ground surface. The native clays are generally firm to stiff in consistency and were encountered below a depth of about 5.5'. An allowable net soil bearing capacity of 2000 psf is recommended for design of column footings and continuous wall footings, if they are designed and constructed in accordance with the criteria stated herein. The recommended design bearing pressure should provide a factor of safety of about 2.5 to 3 against shear failure and limit differential settlements between adjacent columns to less than ¾ inch.

As outlined in the Ground Water Considerations section, ground water may need to be lowered and controlled during footing excavation in many areas where wet sand layers overlie the less permeable clay. As stated previously, if foundation depths are at or not more than a couple feet below ground water level, the water is expected to be controllable by pumping from excavations or properly prepared sumps. If the foundation soils become wet and soft, they may be stabilized with crushed concrete or stone.

The footing size should be calculated to carry the design loads but should be large enough to permit construction tolerances.

All footings should bear on native sand. All exterior footings should extend to a minimum depth of 3 ½ feet for frost protection. Interior footings which do not experience frost may be placed 2 feet below the adjacent floor slab. However, a minimum of 6 inches of engineered fill, such as Class II sand, should be provided between the bottom of the slab-on-grade and the top of the footing below, or other arrangements should be made to allow relative movements.

The ground should be graded to convey surface water away from the building and surface water and water from roof drains should not be allowed to raise the groundwater table along the building foundations.

From a review of the borings and assumptions made about the lower lying soils a seismic site class of D is recommended for design. It is assumed that the lower lying soils below the bottom of the borings have an average N value between 15 and 50 and shear strengths between 1000 and 2000 psf. This appears to be a reasonable assumption from general geology of the area. This is based off of the Michigan Building Code, which incorporates the International Building Code.

5.4 Floor Slabs

The subgrade resulting from the site preparation should provide good support for slabs-on-grade. The general library loads from full bookshelves could be high even though they are distributed over a large area.

5.4 Floor Slabs (Cont'd)

Exposed subgrades deteriorate over time, however, and if left alone for a while the prepared subgrade should again be thoroughly proofrolled immediately prior to placement of fill to raise the grade and slab construction to verify its suitability. Any disturbed materials encountered during the proofroll should be re-compacted or removed and replaced with engineered fill. Subgrade soils for slabs on grade and pavements should be protected against frost during winter construction. Any frozen soils should be thawed and compacted, or removed and replaced with engineered fill prior to slab-on-grade and pavement construction. To permit slab settlement without damaging other structural elements, the slab should be detailed with isolation joints at walls and around footings. As an alternate to construction of isolation joints at column footings, the footings could be separated from the slab with a minimum of six inches of compacted granular fill. Based upon the encountered subgrade soils, the stipulated subgrade preparation procedures, an estimated standard Modulus of Subgrade Reaction (30-inch diameter plate) of 150 pounds per cubic inch may be used for design. To improve the uniformity of support, the slab should be placed on a minimum of four inches of clean compacted granular fill meeting MDOT Class II grading requirements or dense graded crushed aggregate.

The slab performance can be improved through a number of details. Shrinkage cracks can be controlled by installing welded wire fabric in the slab. Cracking can also be reduced through the use of control joints.

Water vapor normally passes through concrete and evaporates from its surface if the concrete is not sealed. Even good quality, well-consolidated concrete is not impermeable to the slow passage of water vapor. Many floor coverings and floor finishes/seals are impermeable, that is, they act like a vapor retarder and the build-up of moisture beneath them is likely to damage the covering/finish. Even when such coverings/finishes are not used, moisture can condense beneath objects on the floor promoting creation of mildew and molds. Furthermore, where the subgrade consists of saturated cohesive soils, water from curing concrete can increase the moisture in the subgrade soils and, in turn, decrease their modulus of subgrade reaction.

For the above reasons, we generally recommend that damp-proofing in the form of a vapor retarder be provided beneath floor slabs that will receive an impermeable floor covering/finish as well as where the floor/room will be used for a purpose that makes passage of water through the floor undesirable.

It should be understood that placement of a vapor retarder beneath a concrete slab reduces but does not eliminate moisture transmission through the slab and suppliers of potential floor covering/finish should be consulted with regard to moisture transmission tolerances. At the same time, placement of a vapor retarder affects the curing of the concrete since it reduces the rate of moisture loss associated with curing of the bottom of the slab. This may result in curling (upward warping) of the slab unless the

5.4 Floor Slabs (Cont'd)

tendency to curling is mitigated in the design. Towards that end a four-inch layer of MDOT Class II sand between the vapor retarder and the bottom of the slab is recommended to allow some moisture loss below the slab. This sand layer will also protect the vapor retarder against damage during construction. Furthermore, properly protecting the surface of the slab from drying out during curing will go a long way towards reducing curling.

5.5 Pavement Design

The subgrade resulting from the subgrade preparation should provide fair to good support for a pavement for the proposed drives and parking lots. At this point we do not have any anticipated traffic counts for the library reconstruction. The following pavement designs are suggested for flexible asphalt pavements.

For automobile drives and minimal truck traffic the following section is suggested:

1 ½ inch asphalt bituminous concrete wearing course (MDOT 13)
2 ½ inch asphalt bituminous concrete leveling course (MDOT 3C)
8 inches untreated aggregate base (MDOT 21AA)

The pavement should be properly crowned and shaped in order to provide effective surface drainage and prevent water ponding. A 1 ½ percent slope is recommended. Drains along the perimeter of the pavement and around catch basins are recommended to prevent water from infiltrating the subgrade. The use of stub drains and edge drains is recommended especially where lawn sprinkling systems may saturate the base course and subgrade.

The nature of the in-situ soils is such that good drainage is expected to be taking place. The pavement recommendations presented above are intended to provide a serviceable pavement for an extended period of time. However, all pavements show deterioration with time and require regular maintenance and occasional repair of cracks. The life expectancy of the pavement is substantially reduced if minor repairs are not performed in a timely manner.

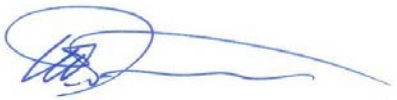
6.0 DESIGN REVIEW AND FIELD MONITORING

The evaluations and recommendations presented in this report relative to site preparation and building foundations have been formulated on the basis of assumed and provided data relating to the location, type and finished grades for the proposed structure and adjacent areas. Any significant change in this data should be brought to our attention for review and evaluation with respect to the prevailing subsoil conditions.

6.0 DESIGN REVIEW AND FIELD MONITORING (Cont'd)

When the building and foundation plans are finalized, a consultation should be arranged with us for a review to verify that the evaluations and recommendations have been properly interpreted.

Soil conditions at the site could vary from those generalized on the basis of test borings made at specific locations. It is therefore recommended that Testing Engineers & Consultants, Inc. be retained to provide soil engineering services during the site preparation, excavation and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications and recommendations. Also, this provides opportunity for design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction.



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Vice President, Geotechnical
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HIP/CJS/ln
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Ms. Oksana Urban
City of Warren
November 30, 2015

TEC Report: 56195

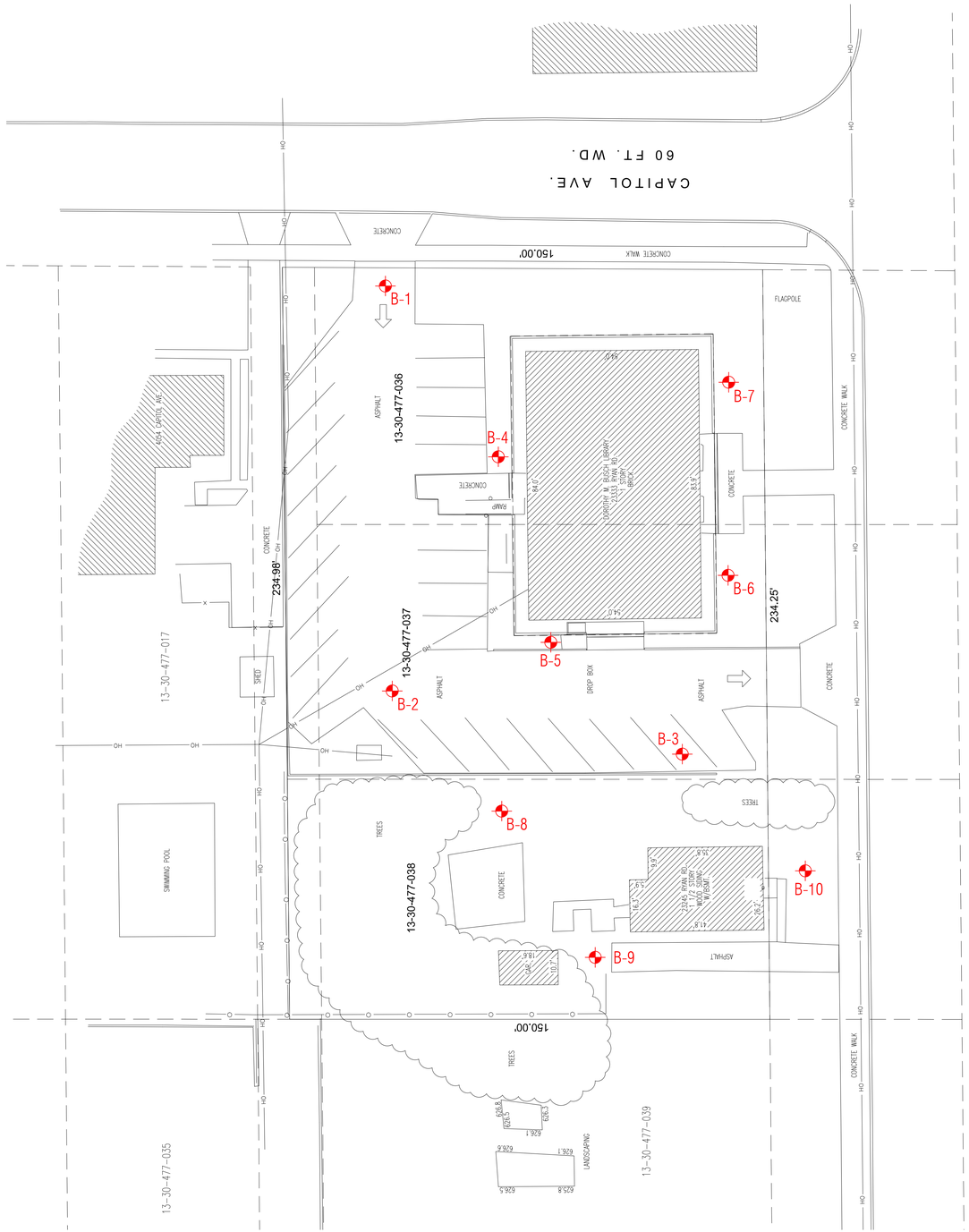
APPENDIX

Test Boring Location Plan

Logs Of Test Borings

Sieve Analysis Results

General Notes For Soil Classification



1 Soil Boring Map
1" = 20'-0"

SOIL BORING LEGEND

LABEL	DEPTH
B-1	20'-0"
B-2	20'-0"
B-3	20'-0"
B-4	20'-0"
B-5	20'-0"
B-6	20'-0"
B-7	20'-0"
B-8	20'-0"
B-9	20'-0"
B-10	20'-0"

NOT FOR CONSTRUCTION

PARTNERS

PARTNERS in Architecture, PLC

65 MARKET STREET
MOUNT CLEMENS, MI 48043
P 586.469.3600
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CONSULTANT

KEY PLAN

OWNER

City of Warren

PROJECT NAME

Dorothy Busch Branch Library - Reconstruction

23333 Ryan Road
Warren, MI 48091

PROJECT NO.

15-142

ISSUES / REVISIONS

N

DRAWN BY

CHECKED BY

APPROVED BY

SHEET NAME

SOIL BORING MAP

SHEET NO.

A_-__

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200 or (313) T-E-S-T-I-N-G
Fax (248) 588-6232

Boring No.: 1 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 10/27/2015

Ground Surface Elevation:

Completed: 10/27/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.29				
			1	ASPHALT (3 1/2")			
	LS	3			16.2	132	4530
		4					
2.5		4		Moist Gravelly Medium To Fine Sand With Trace Of Silt-FILL (8 1/2")			
			3				
	LS	2			16.8	124	
		2		Loose Moist To Very Moist Dark Brown Clayey SAND			
5.0		2	4.7				
			5.5	Loose Wet Brown Fine SAND			
	LS	2			28.0	121	2470
		3	7	Loose Wet Gray Clayey SAND With Some Silt			
7.5		4					
				Firm Moist Gray Oxidized CLAY With Some Silt			
	LS	3			14.5	133	5270
		4					
10.0		7	10	Stiff Moist Gray CLAY With Some Silt & Trace Of Gravel			
				Bottom of Borehole at 10'			
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: 3'0"

At Completion: Caved At 8'3"

Boring No. 1

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
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Fax (248) 588-6232

Boring No.: 2 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 11/9/2015

Ground Surface Elevation:

Completed: 11/9/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.29 / .75	ASPHALT (3 1/2")			
	LS	3 5 6			14.6	133	
2.5			3	CONCRETE (5 1/2")			
	LS	4 5 2		Medium Compact Moist Dark Brown SAND & Topsoil With Trace Of Organic Material Organic Content = 1.7%	18.1	128	
5.0			5.5				
	LS	3 4 6		Loose Moist To Wet Brown SAND	26.7	120	3050
7.5				Firm Moist Gray CLAY With Trace Of Gravel			
	LS	3 6 7			22.8		
10.0			10	Bottom of Borehole at 10'			
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: 3'3"

At Completion: 4'0"

Boring No. 2

Testing Engineers & Consultants, Inc.

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Boring No.: 3 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 10/27/2015

Ground Surface Elevation:

Completed: 10/27/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.29				
			1	ASPHALT (3 1/2")			
	LS	2			13.3	132	
		1					
2.5		2		Moist Gravelly Medium To Fine Sand With Trace Of Silt-FILL (8 1/2")			
			3				
	LS	1	4.2		11.2	119	
		3		Very Loose Moist Dark Brown SAND			
5.0		5					
			6	Loose Wet Brown Fine SAND			
	LS	3			19.3	120	2550
		4		Firm Moist Brown Oxidized CLAY With Some Silt			
7.5		6					
			8				
				Firm Moist Gray CLAY With Some Silt			
	LS	5			13.1	135	7910
		9					
10.0		13	10	Stiff Moist Gray CLAY With Some Silt & Trace Of Gravel			
				Bottom of Borehole at 10'			
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: 3'0"

At Completion: None

Boring No. 3

Testing Engineers & Consultants, Inc.

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Boring No.: 4 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 10/27/2015

Ground Surface Elevation:

Completed: 10/27/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
	LS	2 2 4	1.5	Moist Dark Brown Sandy TOPSOIL	13.7	115	
2.5			3	Loose Moist Brown & Black SAND			
	LS	2 3 3	5.5	Loose Moist To Wet Dark Gray Fine SAND With Trace Of Silt	17.2	118	
5.0							
	LS	2 4 5	8	Stiff Moist Gray Oxidized CLAY With Some Silt	31.8	111	4120
7.5							
	LS	3 5 6		Stiff Moist Gray CLAY With Some Silt & Trace Of Gravel	20.6	125	4860
10.0							
12.5							
	LS	4 6 8			12.2	138	7580
15.0							
17.5							
	LS	3 5 8	20		14.6	132	5770
20.0				Bottom of Borehole at 20'			
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: 4'0"

At Completion: 4'0"

Boring No. 4

Testing Engineers & Consultants, Inc.

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Boring No.: 5 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 11/9/2015

Ground Surface Elevation:

Completed: 11/9/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.33	Moist Dark Brown Sandy TOPSOIL (4")			
	LS	3 5 6			13.5		
2.5			3	Medium Compact Moist Brown Fine SAND			
	LS	9 6 3		Medium Compact Wet Brown Fine SAND	33.3		
5.0			4.8				
	LS	3 4 5		Plastic Moist Gray CLAY With Some Silt & Trace Of Gravel	23.1	120	1980
7.5			8				
	LS	3 5 6		Firm Moist Gray CLAY With Some Silt & Trace Of Gravel	15.1	134	3710
10.0							
12.5							
	LS	4 6 8			14.5	130	3790
15.0							
17.5			18				
	LS	4 5 7		Stiff Moist Gray CLAY With Some Silt & Trace Of Gravel	14.9	132	6260
20.0			20				
				Bottom of Borehole at 20'			
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: 3'0"

At Completion: 18'0"

Boring No. 5

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200 or (313) T-E-S-T-I-N-G
Fax (248) 588-6232

Boring No.: 6 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilling Method: Solid Stem Augers

Drilled By: I. Mickle

Ground Surface Elevation:

Started: 10/27/2015

Completed: 10/27/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.67	Moist Dark Brown Sandy TOPSOIL (8")			
	LS	2 3 3		Loose Moist Brown Fine SAND	7.4	111	
2.5			3.7				
	LS	3 4 3		Loose Wet Brown Fine SAND	18.1	127	
5.0			5.5				
	LS	3 5 6		Stiff Moist Gray Oxidized CLAY With Some Silt & Trace Of Gravel	22.3	120	5360
7.5			8				
	LS	3 5 7		Stiff Moist Gray CLAY With Some Silt & Trace Of Gravel	13.2	136	4370
10.0							
			12				
12.5				Firm Moist Gray CLAY With Some Silt, Trace Of Gravel & Wet Sand Seam At 13'			
	LS	3 4 6			11.3	135	2390
15.0							
17.5							
	LS	3 4 6			12.8	137	2640
20.0			20				
				Bottom of Borehole at 20'			
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: 3'8" & 13'

At Completion: 4'7"

Boring No. 6

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200 or (313) T-E-S-T-I-N-G
Fax (248) 588-6232

Boring No.: 7 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 10/27/2015

Ground Surface Elevation:

Completed: 10/27/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.83	Moist Dark Brown Sandy TOPSOIL (10")			
	LS	8			6.1	124	
		10					
2.5		8		Medium Compact Moist Brown Fine Sand-FILL			
	LS	4	4		14.0		
		4					
5.0		6	5	Medium Compact Moist Dark Gray Clayey SAND With Some Silt & Trace Of Organic Material Organic Content = 2.2%			
	LS	3			25.8	119	2390
		4					
7.5		5	8	Firm Moist Gray Oxidized CLAY With Some Silt & Trace Of Roots			
	LS	4		Stiff Moist Variegated CLAY With Some Silt & Trace Of Gravel	11.1	125	4860
		8					
10.0		10					
			11				
				Stiff Moist Gray CLAY With Some Silt & Trace Of Gravel			
12.5							
	LS	5			10.5	115	
		7					
15.0		9					
17.5							
	LS	4			14.7	135	4120
		5					
20.0		7	20				
				Bottom of Borehole at 20'			
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: None

At Completion: None

Boring No. 7

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200 or (313) T-E-S-T-I-N-G
Fax (248) 588-6232

Boring No.: 8 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 10/27/2015

Ground Surface Elevation:

Completed: 10/27/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			1.1	Moist Dark Brown Sandy TOPSOIL			
	LS	1 2 4			11.8	110	
2.5				Loose Moist Brown Fine SAND			
	LS	4 2 2	4		17.0	108	
5.0			5.5	Loose Wet Brown Fine SAND			
	LS	3 5 7		Stiff Moist Gray CLAY With Some Silt	27.3	118	
7.5							
	LS	3 4 6			19.7	119	4530
10.0			10				
				Bottom of Borehole at 10'			
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: 4'0"

At Completion: Caved At 4'4"

Boring No. 8

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200 or (313) T-E-S-T-I-N-G
Fax (248) 588-6232

Boring No.: 9 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 10/27/2015

Ground Surface Elevation:

Completed: 10/27/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
			.75	Moist Dark Brown Sandy TOPSOIL (9")			
	LS	3 4 5			5.5	111	
2.5				Loose Moist Brown Fine SAND			
	LS	3 4 5			17.9	117	
5.0			5.5				
	LS	2 4 7		Stiff Moist Gray CLAY With Some Silt	23.0	121	
7.5							
	LS	3 5 7			17.5	123	4120
10.0			10				
				Bottom of Borehole at 10'			
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: None

At Completion: None

Boring No. 9

Testing Engineers & Consultants, Inc.

1343 Rochester Road - PO Box 249 - Troy, Michigan - 48099-0249
(248) 588-6200 or (313) T-E-S-T-I-N-G
Fax (248) 588-6232

Boring No.: 10 **Job No.:** 56195

Project: Dorothy Busch Branch Library Reconstruction

Client: City of Warren

Location: Warren, Michigan

Type of Rig: Truck

Drilled By: I. Mickle

Drilling Method: Solid Stem Augers

Started: 10/27/2015

Ground Surface Elevation:

Completed: 10/27/2015

Depth (ft)	Sample Type	N	Strata Change	Soil Classification	w	d	qu
	LS	2 3 5	1.2	Moist Dark Brown Sandy TOPSOIL	2.2	100	
2.5			3	Loose Moist Brown Fine SAND			
	LS	4 6 9		Medium Compact Moist Brown Fine SAND	8.6	107	
5.0			5.5				
	LS	3 5 8		Stiff Moist Gray CLAY With Some Silt	20.6	124	7420
7.5							
	LS	2 5 7			12.6	140	
10.0			10				
				Bottom of Borehole at 10'			
12.5							
15.0							
17.5							
20.0							
22.5							

"N" - Standard Penetration Resistance
SS - 2").D. Split Spoon Sample
LS - Sectional Liner Sample
ST - Shelby Tube Sample
AS - Auger Sample

w - H2O, % of dry weight
d - Bulk Density, pcf
qu - Unconfined Compression, psf
DP - Direct Push
RC - Rock Core

Water Encountered: None

At Completion: None

Boring No. 10

Testing Engineers and Consultants, Inc.

1343 Rochester Road PO Box 249 Troy, Michigan 48099-0249
248-588-6200 or 313 T-E-S-T-I-N-G
Fax 248-588-6232

MECHANICAL ANALYSIS TEST REPORT

PROJECT: Dorothy Busch Branch Library Reconstruction **TEC REPORT NUMBER:** 56195

LOCATION: Waren, Michigan **DATE:** Saturday, November 14, 2015
CLIENT: City of Warren

Material Description: Gravelly Medium to Fine Sand With Trace of Silt Date Sampled: 10/27/15

Sample Source / Depth: B-3 @ 3.5"-1' Sampled By: I. Mickle

Sample Location: TEC Lab Sample Number:

Intended Use: Remarks:

AGGREGATE ANALYSIS

Sieve No.	Total Weight Retained	Total Percent Retained	Total Percent Passing	Specification Range
3"				
2-1/2"				
1-1/2"				
1"				
3/4"				
1/2"		0.0	100.0	
3/8"	40.0	17.4	82.6	
#4	62.0	27.0	73.0	
#10	88.0	38.3	61.7	
#20	118.0	51.3	48.7	
#30	132.0	57.4	42.6	
#40	148.0	64.3	35.7	
#100	195.0	84.8	15.2	
#200	222.0	96.5	3.5	
Total Sample	230.0	100.0	0.0	

SAMPLE DATA

Initial Sample Weight (g)	230.0
Weight After Wash (g)	222.0
Loss in Weight (g)	8.0
Loss by Wash (%)	3.5%

Tested By: R. Pruitt
Reviewed By: G. Putt

Test Method: ASTM C117/C136 _____ AASHTO T11/T27 _____ MTM 108/109 X

Remarks:

Respectfully Submitted:
Testing Engineers and Consultants, Inc.

Testing Engineers and Consultants, Inc.

1343 Rochester Road PO Box 249 Troy, Michigan 48099-0249
248-588-6200 or 313 T-E-S-T-I-N-G
Fax 248-588-6232

MECHANICAL ANALYSIS TEST REPORT

PROJECT: Dorothy Busch Branch Library Reconstruction **TEC REPORT NUMBER:** 56195

LOCATION: Waren, Michigan **DATE:** Saturday, November 14, 2015
CLIENT: City of Warren

Material Description: Gray Fine Sand With Trace of Silt Date Sampled: 10/27/15

Sample Source / Depth: B-4 @ 5' Sampled By: I. Mickle

Sample Location: TEC Lab Sample Number:

Intended Use: Remarks:

AGGREGATE ANALYSIS

Sieve No.	Total Weight Retained	Total Percent Retained	Total Percent Passing	Specification Range
3"				
2-1/2"				
1-1/2"				
1"				
3/4"				
1/2"				
3/8"				
#4				
#10		0.0	100.0	
#20	2.0	0.9	99.1	
#30	6.0	2.6	97.4	
#40	20.0	8.7	91.3	
#100	142.0	61.7	38.3	
#200	214.0	93.0	7.0	
Total Sample	230.0	100.0	0.0	

SAMPLE DATA

Initial Sample Weight (g)	230.0
Weight After Wash (g)	214.0
Loss in Weight (g)	16.0
Loss by Wash (%)	7.0%

Tested By: R. Pruitt
Reviewed By: G. Putt

Test Method: ASTM C117/C136 _____ AASHTO T11/T27 _____ MTM 108/109 X

Remarks:

Respectfully Submitted:
Testing Engineers and Consultants, Inc.

Testing Engineers & Consultants, Inc.

Ms. Oksana Urban
City of Warren
November 30, 2015

TEC Report: 56195

SOIL DESCRIPTIONS

In order to provide uniformity throughout our projects, the following nomenclature has been adopted to describe soil characteristics:

CONSISTENCY AND RELATIVE DENSITY

COHESIVE SOILS			GRANULAR SOILS	
UNCONFINED COMPRESSIVE STRENGTH, PSF	**"N" VALUES**	**CONSISTENCY**	**"N" VALUES**	**RELATIVE DENSITY**
Below 500	0 – 2	Very Soft	0 – 4	Very Loose
500 – 1,000	3 – 4	Soft	5 – 10	Loose
1,000 – 2,000	5 – 8	Plastic	11 – 30	Medium Compact
2,000 – 4,000	9 – 15	Firm	31 – 50	Compact
4,000 – 8,000	16 – 30	Stiff	50+	Dense
8,000 – 16,000	31 – 50	Ex. Stiff		
Over 16,000	51+	Hard		

Material Types By Particle Size	**ASTM D2487**
BOULDERS	Stones Over 12" In Diameter
COBBLES	Stones 3" To 12" In Diameter
GRAVEL	#4 To 3" Diameter
COARSE SAND	#10 To #4 Sieves
MEDIUM SAND	#40 To #10 Sieves

SOIL DESCRIPTIONS (Cont'd)

Material Types By Particle Size	**ASTM D2487**
FINE SAND	#200 To #40 Sieves
SILT	Minus #200 Sieve Material, Fairly Non-Plastic, Falls Below "A"-Line
CLAY	Minus #200 Sieve Material Plastic Material That Has A Tendency To Stick Together, Can Be Rolled Into Fine Rods When Moistened; Falls Above "A"-Line
PEAT	Black Organic Material Containing Partially Decayed Vegetable Matter
MARL	Fresh Water Deposits Of Calcium Carbonate, Often Containing Percentages Of Peat, Clay & Fine Sand
SWAMP BOTTOM DEPOSITS	Mixtures Of Peat, Marl, Vegetation & Fine Sand Containing Large Amounts Of Decayable Organic Material

DOCUMENT 004313 - BID SECURITY FORMS

1.1 BID FORM SUPPLEMENT

A. A completed bid bond form is required to be attached to the Bid Form.
   1. A certified check is also an acceptable means of providing the required bid security. Certified check must be payable to the “City of Warren”.

1.2 BID BOND FORM

A. AIA Document A310, "Bid Bond," is the recommended form for a bid bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid Form as a supplement.

B. Copies of AIA standard forms may be obtained from The American Institute of Architects; www.aia.org/contractdocs/purchase/index.htm; email: docspurchases@aia.org; (800) 942-7732.

END OF DOCUMENT 004313

DOCUMENT 004373 - PROPOSED SCHEDULE OF VALUES FORM

1.1 POST BID SUPPLEMENT

A. A completed Proposed Schedule of Values form is required to be provided, upon request from Architect after bid has been submitted.

1.2 PROPOSED SCHEDULE OF VALUES FORM

A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual table of contents. Provide multiple line items for principal material and subcontract amounts in excess of five percent of the Contract Sum.

B. Arrange schedule of values consistent with format of AIA Document G703.

1. Copies of AIA standard forms may be obtained from the American Institute of Architects; http://www.aia.org/contractdocs/purchase/index.htm; docspurchases@aia.org; (800) 942-7732.

END OF DOCUMENT 004373

DOCUMENT 006000 - FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:
   1. To be provided by Owner.

1.2 ADMINISTRATIVE FORMS

A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.

B. Copies of AIA standard forms may be obtained from the American Institute of Architects; http://www.aia.org/contractdocs/purchase/index.htm; docspurchases@aia.org; (800) 942-7732.

C. Preconstruction Forms:

   1. Form of Performance Bond and Labor and Material Bond: AIA Document A312, "Performance Bond and Payment Bond."
   2. Form of Certificate of Insurance: AIA Document G715, "Supplemental Attachment for ACORD Certificate of Insurance 25-S."

D. Information and Modification Forms:
   1. Form of Request for Proposal: AIA Document G709, "Work Changes Proposal Request."
   2. Change Order Form: AIA Document G701, "Change Order."
   3. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G707, "Architect's Supplemental Instructions."
   4. Form of Change Directive: AIA Document G714, "Construction Change Directive."

E. Payment Forms:

   1. Schedule of Values Form: AIA Document G703, "Continuation Sheet."
   2. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet."
   3. Form of Contractor's Affidavit: AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   4. Form of Affidavit of Release of Liens: AIA Document G706A, "Contractor's Affidavit of Payment of Release of Liens."
   5. Form of Consent of Surety: AIA Document G707, "Consent of Surety to Final Payment."

END OF DOCUMENT 006000

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Access to site.
5. Work restrictions.
6. Specification and drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Dorothy M. Busch Library

1. Project Location: 23333 Ryan Road, Warren, MI 48091.

B. Owner: City of Warren

1. Owner's Representative: Oksana Urban, Library Director.

C. Architect: PARTNERS in Architecture, PLC; 65 Market Street, Suite 200, Mount Clemens, MI 48043.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The project includes the combination of two adjacent sites into a single development. Two structures will be demolished, the existing Dorothy M. Busch Branch Library as well as an adjacent residential 2-story house. The sites will be cleared of paving, landscaping and select components to prepare the site for new development. A new 6,640 square foot Library will be constructed on the combined site along with a new parking lot, site amenities and utilities. The building will be constructed of a primary steel frame with masonry clad, metal stud walls, sloped metal roof, and aluminum and glass storefronts.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 BID / PROJECT SCHEDULE

A. The projected bid / project schedule milestones are as follows:
   1. Issue Documents for bid: January 15, 2016.
   2. Pre-Bid Meeting: January 22, 2016; 9:00am.
   3. Last Day to Submit Questions: February 3, 2016.
   4. Bids Due: February 10, 2016; 12:30pm.
   5. Contractor Interviews: February 16 and 17, 2016.
   6. Projected Contract Award Date: March 8, 2016.
   7. Construction Commencement: As soon as possible.
   8. Achieve Substantial Completion: December 16, 2016.
      a. Building must be ready for occupancy. All inspections / approvals must be received to allow occupancy.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Preceding Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

   1. Hazardous material abatement.

C. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

   1. Video Surveillance system installation.

   2. Furniture procurement and installation.

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors with Owner.

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

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:
   1. Quantity allowances.
   2. Contingency allowances.

C. Related Requirements:

   1. Section 012200 "Unit Prices" for procedures for using unit prices.
   2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.2 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.3 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance, unless other methods described elsewhere in the Contract Documents.

B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.4 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.5 QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.6 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.7 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between approved quantity used and the quantity allowance defined in paragraph 3.3 below. Unit price per specification section 012200 will be used to adjust the total cost up or down.
   1. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. *Allowance No. 1 – Owner's Contingency Allowance*: Include a Contingency Allowance in the sum of $200,000 in the base bid amount. This Contingency Allowance is to be used at the sole discretion of the Owner and cannot be used by the Contractor without written authorization from the Owner and Architect.

   1. All remaining unused amounts will be credited back to the Owner at substantial completion or other appropriate time, as defined by the Owner.

2. Contractor is not authorized to utilize allowance without written authorization from the Owner and Architect

3. Approved uses will be defined by written Change Orders.

B. *Allowance No. 2: Soil Corrections Quantity*: Include 180 Cubic Yards of soil corrections (removal of unsuitable soil and replacement with engineered fill) in base bid. This quantity will be increased or decreased based upon the actual conditions in the field with the assistance of the Owner's testing engineer. The contract amount will be increased or decreased based upon the unit cost as described in specification section 012200 – Unit Prices.

1. This allowance includes material cost, receiving, handling, and installation and Contractor overhead and profit.

2. Coordinate quantity allowance adjustment with corresponding unit-price requirements in Section 012200 "Unit Prices."

3. Contractor is not authorized to utilize allowance without written authorization from the Owner, Architect and Owner's Testing Engineer.

4. Approved uses will be defined by written Change Orders.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

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

1.3 PROCEDURES

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

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

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1 – Undercutting Subgrade (Soil Corrections):

1. Description: This item shall include the labor, supervision, equipment, trucking, unsuitable material removal and disposal and new material necessary for the excavation of unsuitable material as determined by the Owner's Testing Engineer. Work will include grading and compaction of the undercut area and installing MDOT Class II granular material to the proposed subgrade elevation. The material shall be installed at a maximum depth of 12" per lift. The work will be paid for by in-field measurement quantities per cubic yard, as determined by the Owner's Testing Engineer.

2. Unit of Measurement: Cubic Yard (measured in place).

3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

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

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. <u>Alternate No. 1: Replacement of Existing North Sidewalk.</u>

1. Base Bid: The base bid is to leave the existing sidewalk on the North end of the site as shown on drawings C3-01 and A2-01.

2. Alternate: The alternate is to remove the existing sidewalk on the North end of the site (approximately 80 lineal feet of 5 foot wide concrete sidewalk) and replace it with new concrete walk per 4-inch concrete walk detail on drawing C4-01.

B. Alternate No. 2: Decorative City of Warren 'W' logo in entrance plaza concrete.

1. Base Bid: The base bid is to install colored concrete walk throughout the entrance plaza as shown in the Enlarged Walk Grading Detail on drawing C3-01.

2. Alternate: The alternate is to add the City of Warren's 'W' logo to the concrete by method of sandblasting through a water-jet cut steel template to achieve a contrasting finish texture.

C. Alternate No. 3: Side folding gate in Pre-Function area.

1. Base Bid: The base bid is to omit the side folding gate (Door No. 103) as scheduled on drawing A0-03 and all associated work as described below in the alternate description. The East wall of Restroom '113' is to extend through to the to the South wall of the room and omit the framed pocket. All finishes on both sides of the wall, floor finishes and acoustical ceiling in the restroom would continue and follow the room perimeter.

2. Alternate: The alternate is to include the side folding gate (Door No. 103) as scheduled on drawing A0-03 and all associated work including, but not limited to the following;
   a. Pocket wall framing as shown in detail 8/A3-10.
   b. Bulkhead framing, gypsum board and paint finishing as shown in detail 12/A6-11.
   c. Concrete foundations at both ends as shown on drawing S3-01 and scheduled on S4-01.
   d. Steel columns at both ends as shown on drawing S3-02 and scheduled on S4-01.
   e. Steel beam spanning between the columns as shown on drawing S3-02.

D. Alternate No. 4: Provide and install standard acoustical roof deck in lieu of EpicDeck.

1. Base Bid: The base bid is to provide EpicDeck throughout the building's 1.5:12 sloped roof areas as shown on drawing S3-02.

2. Alternate: The alternate is to provide 1.5" acoustical metal deck in the areas noted in the Alternate Roof Deck Plan on drawing S3-02. This deck is to be painted PNT-9 in the exposed areas. Provide Uni-Strut mounting channels as required for all fixtures and items to be hung in lieu of EpicDeck hangers as shown on drawing A4-10.

E. Alternate No. 5: Monument Sign.

1. Base Bid: The base bid is to omit the monument sign and foundation as shown on drawing A2-01 and detail 4/A2-02. All electrical conduit as shown on drawing E3-01 to remain in base bid with pull-strings. Electrical wiring to be omitted. All landscaping around the monument sign as shown on drawing L1-01 including (4) Karl Forester Reed Grass, (10) Bar Harbor Juniper, Annual Flower Plantings, Ryerson Steel Edging and Shredded Bark Mulch to be omitted and the area replaced with Irrigated Sod Lawn.

2. Alternate: The alternate is to include the monument sign and foundation as shown on drawing A2-01 and detail 4/A2-02. The sign is to be powered and controlled from the building as shown on drawing E3-01. All landscaping as shown on drawing L1-01 to be included.

F. Alternate No. 6: Concrete Screen Wall Staining.

1. Base Bid: The base bid is to omit staining of both the existing and new concrete screen walls as shown on drawing A2-01 and detail 2/A2-02.

2. Alternate: The alternate is to include the staining of both the existing and new concrete screen walls as shown on drawing A2-01 and detail 2/A2-02. The walls are to be stained on the Library's side only. The walls, while different in age are to appear as one cohesive color as selected by the Architect.

G. Alternate No. 7: Building Management System.

1. Base Bid: The base bid is to omit the building management system as shown on drawing M7-01 and provide programmable thermostats in the Work Area for each mechanical unit with remote sensors as located on the drawings.

2. Alternate: The alternate is to include the building management system as shown on drawing M7-01.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution will not adversely affect Contractor's construction schedule.
c. Requested substitution has received necessary approvals of authorities having jurisdiction.
d. Requested substitution is compatible with other portions of the Work.
e. Requested substitution has been coordinated with other portions of the Work.
f. Requested substitution provides specified warranty.

g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

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

1.3 PROPOSAL REQUESTS

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

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail or forms acceptable to Architect.

B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Line items shall be provided for separate labor and

material cost amounts. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

a. Include separate line items under Contractor as well as principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and individual subcontract amounts.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

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

C. Payment Application Times: Submit Application for Payment to Architect by the last day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

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

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of approved Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Sustainable design submittal for project materials cost data.
4. Contractor's construction schedule (preliminary if not final).
5. Sustainable design action plans.
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707-1994, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination drawings.
2. Requests for Information (RFIs).
3. Project meetings.

B. Related Requirements:
1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

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

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor 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 information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: AIA Document G716 or form acceptable to Architect.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "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 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:

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.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

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: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within five days of the meeting.

B. Preconstruction Conference: Schedule and conduct 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.

1. Attendees: Authorized representatives of Owner, Architect and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Critical work sequencing and long-lead items.
c. Designation of key personnel and their duties.
d. Procedures for processing field decisions and Change Orders.
e. Procedures for RFIs.
f. Procedures for testing and inspecting.
g. Procedures for processing Applications for Payment.
h. Distribution of the Contract Documents.
i. Submittal procedures.
j. Sustainable design requirements.
k. Preparation of record documents.
l. Use of the premises.
m. Work restrictions.
n. Working hours.
o. Owner's occupancy requirements.
p. Responsibility for temporary facilities and controls.
q. Procedures for moisture and mold control.
r. Procedures for disruptions and shutdowns.
s. Parking availability.
t. Office, work, and storage areas.
u. Equipment deliveries and priorities.
v. First aid.
w. Security.
x. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity 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. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Sustainable design requirements.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility problems.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.

p. Compatibility of materials.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

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

D. Progress Meetings: Conduct progress meetings at weekly intervals.

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 meeting 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) Status of sustainable design documentation.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.

10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of proposal requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. Daily Construction Reports: Submit at weekly intervals.

E. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 30 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

a. Structural steel.

b. Lighting and electrical equipment.

c. HVAC equipment and systems.

d. Aluminum window / storefront framing and door, glazing.

e. Interior doors and hardware.

f. Metal panels, trim and roofing.

3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Provisions for future construction.
g. Seasonal variations.
h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use Microsoft Project or other software approved by Architect.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in [10] <Insert number> percent increments within time bar.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

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

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves] the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

    j. Number and title of appropriate Specification Section.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.
    m. Other necessary identification.

4. Additional Paper 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.

    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.

    a. Transmittal Form for Paper Submittals: Use facsimile of sample form included in Project Manual.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use facsimile of sample form included in Project Manual.

F. Options: Identify options requiring selection by Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

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 approval notation from Architect's action stamp.

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: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals via email as PDF electronic files.

    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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 published 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 catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.

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. Identification of products.

b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: 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 42 inches.
3. Submit Shop Drawings in the following format:

a. PDF electronic file.

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.
d. Number and title of applicable Specification Section.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. 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.

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; remainder will be returned.

1) 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: 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. Submit product schedule in the following format:

a. PDF electronic file.

F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures.

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

U. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."

V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Y. Design Data: Prepare and submit 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.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file 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. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. 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 revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. No comments noted
2. Comments Noted
3. Revise and send record copies
4. Resubmit information
5. Rejected

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

PARTNERS in Architecture, PLC

SHOP DRAWING & SAMPLES TRANSMITTAL

CONTRACTOR / CONST. MGR. _____

SUB-CONRTACTOR / SUPPLIER _____

PROJECT NAME: _____

CITY: _____

PROJECT #: _____

DATE SUBMITTED: _____

SUBMITTAL #: _____

RESUBMIT#: _____

TO: A _____ M _____ C _____

S _____ E _____

SPEC SECTION #	SPEC Subsection	No. Prints	No. Sepia	No. Cat.	No. Samp.	SUB-CONTRACTOR / MANUF. / SUPPLIER	DWG. NO.	DRAWING / ITEM DESCRIPTION (List each drawing number per line.)	A/E ACTION		TO CONTR.	
									ACTION CODE	REVIEW DATE	DATE RETURN	NUMBER COPIES

The undersigned certifies that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract documents execpt as otherwise noted.
Review of items submitted does not relieve contractor from complying with all requirements of the contract documents.

CONTRACTORS COMMENTS:

SIGNATURE

ARCH / ENG. COMMENTS:

SIGNATURE

ROUTING INFORMATION-PIA USE ONLY

PARTNERS REC'D _____

OUT TO CONS. _____

REC'D FROM CONS. _____

RET. TO CONTR. _____

REVIEW COMPLETED AS INDICATED:

NC: No Comment

CN: Comments Noted

RR: Revise and Send Record Copy

RI: Resubmit Information

XX: Rejected, Non-Compliance

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

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

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

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

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

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

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

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

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting / Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

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

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

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

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

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.abma.com.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.

35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; (See ECIA).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; www.eciaonline.org.
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.

82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
83. FM Approvals - FM Approvals LLC; www.fmglobal.com.
84. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
86. FSA - Fluid Sealing Association; www.fluidsealing.com.
87. FSC - Forest Stewardship Council U.S.; www.fscus.org.
88. GA - Gypsum Association; www.gypsum.org.
89. GANA - Glass Association of North America; www.glasswebsite.com.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
93. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
94. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
95. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
96. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
97. IAS - International Accreditation Service; www.iasonline.org.
98. IAS - International Approval Services; (See CSA).
99. ICBO - International Conference of Building Officials; (See ICC).
100. ICC - International Code Council; www.iccsafe.org.
101. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
102. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
103. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
104. IEC - International Electrotechnical Commission; www.iec.ch.
105. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
106. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
107. IESNA - Illuminating Engineering Society of North America; (See IES).
108. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
109. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
110. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
111. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
112. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
113. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
114. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
115. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
116. ISO - International Organization for Standardization; www.iso.org.
117. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
118. ITU - International Telecommunication Union; www.itu.int/home.
119. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
120. LMA - Laminating Materials Association; (See CPA).
121. LPI - Lightning Protection Institute; www.lightning.org.
122. MBMA - Metal Building Manufacturers Association; www.mbma.com.
123. MCA - Metal Construction Association; www.metalconstruction.org.
124. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
125. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
126. MHIA - Material Handling Industry of America; www.mhia.org.

127. MIA - Marble Institute of America; www.marble-institute.com.
128. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
129. MPI - Master Painters Institute; www.paintinfo.com.
130. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
131. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
132. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
133. NADCA - National Air Duct Cleaners Association; www.nadca.com.
134. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
135. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
136. NBI - New Buildings Institute; www.newbuildings.org.
137. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
138. NCMA - National Concrete Masonry Association; www.ncma.org.
139. NEBB - National Environmental Balancing Bureau; www.nebb.org.
140. NECA - National Electrical Contractors Association; www.necanet.org.
141. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
142. NEMA - National Electrical Manufacturers Association; www.nema.org.
143. NETA - InterNational Electrical Testing Association; www.netaworld.org.
144. NFHS - National Federation of State High School Associations; www.nfhs.org.
145. NFPA - National Fire Protection Association; www.nfpa.org.
146. NFPA - NFPA International; (See NFPA).
147. NFRC - National Fenestration Rating Council; www.nfrc.org.
148. NHLA - National Hardwood Lumber Association; www.nhla.com.
149. NLGA - National Lumber Grades Authority; www.nlga.org.
150. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
151. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
152. NRCA - National Roofing Contractors Association; www.nrca.net.
153. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
154. NSF - NSF International; www.nsf.org.
155. NSPE - National Society of Professional Engineers; www.nspe.org.
156. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
157. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
158. NWFA - National Wood Flooring Association; www.nwfa.org.
159. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
160. PDI - Plumbing & Drainage Institute; www.pdionline.org.
161. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
162. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
163. RFCI - Resilient Floor Covering Institute; www.rfci.com.
164. RIS - Redwood Inspection Service; www.redwoodinspection.com.
165. SAE - SAE International; www.sae.org.
166. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
167. SDI - Steel Deck Institute; www.sdi.org.
168. SDI - Steel Door Institute; www.steeldoor.org.
169. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
170. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
171. SIA - Security Industry Association; www.siaonline.org.
172. SJI - Steel Joist Institute; www.steeljoist.org.
173. SMA - Screen Manufacturers Association; www.smainfo.org.
174. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.

175. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
176. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
177. SPIB - Southern Pine Inspection Bureau; www.spib.org.
178. SPRI - Single Ply Roofing Industry; www.spri.org.
179. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
180. SSINA - Specialty Steel Industry of North America; www.ssina.com.
181. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
182. STI - Steel Tank Institute; www.steeltank.com.
183. SWI - Steel Window Institute; www.steelwindows.com.
184. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
185. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
186. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
187. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
188. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
189. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
190. TMS - The Masonry Society; www.masonrysociety.org.
191. TPI - Truss Plate Institute; www.tpinst.org.
192. TPI - Turfgrass Producers International; www.turfgrasssod.org.
193. TRI - Tile Roofing Institute; www.tileroofing.org.
194. UL - Underwriters Laboratories Inc.; www.ul.com.
195. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
196. USAV - USA Volleyball; www.usavolleyball.org.
197. USGBC - U.S. Green Building Council; www.usgbc.org.
198. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
199. WASTEC - Waste Equipment Technology Association; www.wastec.org.
200. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
201. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
202. WDMA - Window & Door Manufacturers Association; www.wdma.com.
203. WI - Woodwork Institute; www.wicnet.org.
204. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
205. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.

7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.3 EQUIPMENT

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

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

I. Electronic Communication Service: Provide a desktop computer in the primary field office adequate to access project electronic documents and maintain electronic communications.

1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
2. Internet Service: Provide wireless or broadband service with access to the internet.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Limited site area will be available for parking. Contractor responsible to coordinate parking arrangements for construction personnel. Do not negatively impact local neighboring streets with construction parking.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and authorities having jurisdiction.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site .
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner and Architect.

I. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Discard or replace water-damaged and wet material.
4. Discard, replace, or clean stored or installed material that begins to grow mold.
5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.2 DEFINITIONS

A. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

B. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

C. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1.4 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA, licensed arborist in jurisdiction where Project is located, current member of ASCA, or registered Consulting Arborist as designated by ASCA.

1.5 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.

B. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches (2400 mm) apart. High-visibility orange color.

a. Height: 48 inches (1200 mm).

C. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

3.2 PREPARATION

A. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

B. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones in a manner that will prevent people from easily entering protected areas except by entrance gates.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

3.4 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

C. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.5 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.6 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
2. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch uniform thickness to remain.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

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

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

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence

and location of underground utilities, mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

1. Architect will provide an initial construction layout of the building footprint. Contractor will be responsible for all other staking and layout.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete 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 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.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

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.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:
1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
3. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

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

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Architect, will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using

appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set of marked-up record prints.

b. Final Submittal:
1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Record data as soon as possible after obtaining it.
    c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: DWG, Version: AutoCAD 2014 or later; Microsoft Windows operating system.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

B. Format: Submit record Product Data as annotated PDF electronic file.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.

f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:

   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:

   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:

   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.

C. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Salvaging items for reuse by Owner.

B. Related Requirements:

1. Section 011000 "Summary" for use of the premises and phasing requirements.
2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.
8. Review procedures for informing neighboring property owners.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before the Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: Present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

E. On-site storage or sale of removed items or materials is not permitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

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

B. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
    a. Items that are to be salvaged and reinstalled by contractor shall be stored and secured by Contractor.
5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off utilities when requested by Contractor.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

3. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged are indicated on Drawings.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.7 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.10 CLEANING

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

1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 033000 - CAST-IN-PLACE CONCRETE

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 specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings and non-exposed foundation walls.
2. Exposed foundation walls.
3. Slabs-on-grade.
4. Supported slabs.

B. Related Sections include the following:
1. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Repair materials.

F. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

G. Field quality-control test and inspection reports.

H. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Ready-mix concrete manufacturer.
c. Concrete subcontractor.
d. Architect and Engineer.
e. Owner’s Testing Agency.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project unless noted otherwise:

1. Portland Cement: ASTM C 150, Type I gray or supplement with the following:
   a. Fly Ash: ASTM C 618, Class C or F (in footing mix only, mix 25% of cement content.).
   b. Ground Granulated Blast-Furnace Slag: (in footing mix only, max 35% of Cement content).ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 VAPOR BARRIER/ RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A, not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:
   a. Fortifiber Corporation; Moistop Ultra 15.
   b. Raven Industries Inc.; Vapor Block 15.
   c. Reef Industries, Inc.; Vapor Guard T85.
   d. Stego Industries, LLC; Stego Wrap, 15 mils.

B. Granular Fill: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 CURING MATERIALS

C. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:

   a. Axim Concrete Technologies; Cimfilm.
   b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
   c. Dayton Superior Corporation; Sure Film.
   d. Euclid Chemical Company (The); Eucobar.
   e. L&M Construction Chemicals, Inc.; E-Con.
   f. Meadows, W. R., Inc.; Sealtight Evapre.
   g. Sika Corporation, Inc.; SikaFilm.
   h. Symons Corporation, a Dayton Superior Company; Finishing Aid.

D. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

E. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

F. Water: Potable.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products:
   a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
   b. Dayton Superior Corporation; Safe Cure and Seal (J-19).
   c. Euclid Chemical Company (The); Diamond Clear VOX.
   d. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   e. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
   f. Meadows, W. R., Inc.; Vocomp-20.
   g. Sonneborn, Div. of ChemRex; Kure-N-Seal.
   h. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.9 REPAIR MATERIALS

A. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

A. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 35 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Non-exposed Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.48.
3. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. 5 sack mix minimum, 470# cement.

B. Exposed Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
5. 6 sack mix minimum, 564# cement.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3,500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.48.

3. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

D. Exterior Concrete (Supported Slabs): Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,000 psi (24.1 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.48.
3. Slump Limit4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
1. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class B, 1/4 inch (6 mm) for smooth-formed finished surfaces.
2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install dovetail anchor slots in concrete structures as indicated.

3.3 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

2. Seal all penetrations with +/-24” square pieces of the vapor retarder and with slip-fit over penetrations and tape, including all four sides. Taping around penetration without this piece will not be permitted.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- (3.05-m-) long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 LIQUID FLOOR TREATMENTS

A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive, patching mortar and concrete.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

3.14 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer

END OF SECTION 033000

SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Clay face brick.
2. Decorative concrete block.

B. Products Installed but Not Furnished under This Section:

1. Steel lintels in masonry veneer.
2. Steel shelf angles for supporting masonry veneer.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type and color of brick, decorative masonry block and colored mortar.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product.

1.4 QUALITY ASSURANCE

A. Sample Panels: Build sample wall to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample of typical exterior wall, minimum dimension of 60 inches (1500 mm) long by 48 inches (1200 mm)] high by full thickness. Show all wall components including by not limited to: Metal studs, sheathing, vapor barrier, insulation, flashing, masonry, masonry accessories, etc. Include window jamb and sill as well. Coordinate with other sections.

1.5 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.2 BRICK

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C 216.
1. Grade SW.
2. Type FBX.
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
6. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.
1. Color and Texture: (FB-##); Refer to ‘Material Finish / Color Schedule Section 000200’ for brick manufacturer and color selections.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

C. Decorative CMUs: ASTM C 90.

1. Basis of Design: Grand Blanc Cement Products: 800-875-7500. Color Refer to 'Material Finish / Color Schedule Section 000200' for color selections. Equal products in color by National Block or Best Block are acceptable.
   a. Units shall be integrally colored and furnished with a factory applied masonry sealer.
   b. In addition to integral water repellent, apply manufacturer recommended burnished block sealer (low sheen) in field, once wall has been cleaned and accepted. Sealer shall be applied in thickness as recommended by manufacturer and application method shall also be approved by manufacturer.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
3. Density Classification: Normal weight.
4. Pattern and Texture:
   a. Standard pattern, ground-face finish.
   b. Standard pattern, split-face finish.
5. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 7-5/8 inches (194 mm) high by 15-5/8 inches (397 mm) long.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

E. Aggregate for Mortar: ASTM C 144.

1. White-Mortar Aggregates: Natural white sand or crushed white stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete block containing integral water repellent from same manufacturer.

H. Water: Potable.

2.5 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized-steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) 0.25-inch- (6.35-mm-) diameter, hot-dip galvanized-steel wire.

D. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf (445-N) load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch (1.5 mm).
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch- (1.90-mm-) thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- (4.76-mm) diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with a projecting vertical tab having a slotted hole for inserting wire tie.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Wire-Bond; “2401 RJ-711 Adjustable Veneer Anchor” or comparable product by one of the following:

1) FERO Corporation.
2) Hohmann & Barnard, Inc.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:

1. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
2. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).

a. Basis-of-Design Product: Subject to compliance with requirements, provide Grace Construction Products; W.R. Grace & Co. -- Conn. ; Perm-A-Barrier Wall Flashing. or a comparable product by one of the following:

1) Advanced Building Products Inc.
2) Carlisle Coatings & Waterproofing Inc.
3) Heckmann Building Products, Inc.
4) Hohmann & Barnard, Inc.
5) Polyguard Products, Inc.
6) W. R. Meadows, Inc.
7) Williams Products, Inc.
8) Wire-Bond.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Weep/Vent Products: Use[one of] the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Wire-Bond ; Cell Vent (#3601). or a comparable product by one of the following:

1) Advanced Building Products Inc.
2) Heckmann Building Products, Inc.
3) Hohmann & Barnard, Inc.

C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Wire-Bond; Cavity Net or a comparable product by one of the following:

a. Advanced Building Products Inc.
b. CavClear/Archovations, Inc.
c. Heckmann Building Products, Inc.
d. Hohmann & Barnard, Inc.
e. Mortar Net Solutions.

2. Configuration: Provide one of the following:
a. Strips, not less than 3/4 inch (19 mm) thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.8 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc ; Sure Klean® 600. or a comparable product by one of the following:

a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
b. EaCo Chem, Inc.

2.9 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Use Type N unless another type is indicated.

D. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Application: Use pigmented mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 25 inches (635 mm) o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. (0.25 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL

A. Anchor masonry to structural steel, where masonry abuts or faces structural steel to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.7 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.8 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Prior to Construction: One set of tests.

C. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

D. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.9 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

3.10 MASONRY WASTE DISPOSAL

A. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613

SECTION 047200 - CAST STONE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cast stone trim and sills.

1.2 SUBMITTALS

A. Product Data: Include dimensions of individual components.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

C. Samples: For each color and texture of cast stone required.

D. Colored Mortar Samples: For each mortar color required.

E. Qualification Data: For manufacturer.

F. Material Test Reports.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, with sufficient production capacity to manufacture required units.

1. Manufacturer is a producing member of the Cast Stone Institute.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Cast Stone, Inc.
2. American Artstone Co., Inc.
3. Architectural Art Stone, Inc.
4. Architectural Cast Stone Corp.
5. Architectural Cast Stone, Inc.
6. Architectural Concrete Company, Inc.
7. Architectural Molded Composites, Inc.

8. Architectural Ornamental Castings, Inc.
9. Architectural Ornaments, Inc.
10. Artisan Stone Company, Inc.
11. Cast Stone Systems, Inc.
12. Classic Cast Stone of Dallas, Inc.
13. Continental Cast Stone East; Russell, Inc.
14. Continental Cast Stone Manufacturing, Inc.
15. Custom Cast Stone, Inc.
16. Dura Art Stone.
17. DuraStone.
18. Pineapple Grove Designs.
19. Royal Stone.
20. Stone Castle Industries, Inc.
21. Techcrete Architectural Precast.

2.2 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364 using the vibrant dry tamp or wet-cast method.

1. Provide units that are resistant to freezing and thawing.
2. Slope exposed horizontal surfaces 1:12, unless otherwise indicated.
3. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
4. Provide drips on projecting elements, unless otherwise indicated.

B. Cure units by one of the following methods:

1. Cure units with steam in enclosed curing room at temperature of 105 deg F (41 deg C) or above and 95 to 100 percent relative humidity for 6 hours.
2. Cure units with dense fog and water spray in enclosed warm curing room at 95 to 100 percent relative humidity for 24 hours.
3. Cure units to comply with one of the following:

    a. Not less than 5 days at mean daily temperature of 70 deg F (21 deg C) or above.
    b. Not less than 6 days at mean daily temperature of 60 deg F (16 deg C) or above.
    c. Not less than 7 days at mean daily temperature of 50 deg F (10 deg C) or above.
    d. Not less than 8 days at mean daily temperature of 45 deg F (7 deg C) or above.

C. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

D. Colors and Textures: Refer to 000200 Material Finish / Color Schedule for color selections.

2.3 ACCESSORIES

A. Anchors and Dowels: Type 304 stainless steel.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner complying with requirements in Division 4 Section "Unit Masonry Assemblies" and approved for intended use by cast

stone manufacturer and approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.4 MORTAR

A. Comply with requirements in Division 4 Section "Unit Masonry Assemblies" for mortar materials and mixes.

1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.
3. Pigmented Mortar: Use colored cement product.

2.5 SOURCE QUALITY CONTROL

A. Employ an independent testing agency to sample and test cast stone units according to ASTM C 1364.

PART 3 - EXECUTION

3.1 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Division 4 Section "Unit Masonry Assemblies."

B. Set units in full bed of mortar with full head joints, unless otherwise indicated.

1. Fill dowel holes and anchor slots with mortar.
2. Fill collar joints solid as units are set.
3. Build concealed flashing into mortar joints as units are set.
4. Keep head joints in coping and other units with exposed vertical surfaces open to receive sealant.
5. Keep joints at shelf angles open to receive sealant.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated. Rake all sill and horizontal joints 1/4-inch and provide sealant in joints.

D. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated. Keep joints free of mortar and other rigid materials.

E. Prepare joints indicated to receive sealant and apply sealant of type and at locations indicated to comply with applicable requirements in Division 7 Section "Joint Sealants."

3.2 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except due to warpage of units.

3.3 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

1. Replace units in a manner that shows no evidence of replacement.

B. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone to comply with requirements in Division 4 Section "Unit Masonry Assemblies."

END OF SECTION 047200

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes structural steel.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using AISC 360.
2. Use ASD; data are given at service-load level.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

C. Qualification Data: For qualified Installer, fabricator, testing agency.

D. Welding certificates.

E. Mill test reports for structural steel, including chemical and physical properties.

F. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.

3. RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

C. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc coating.

E. Unheaded Anchor Rods: ASTM F 1554, Grade 36, ASTM F 1554, Grade 55, weldable.

1. Configuration: Straight.
2. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

F. Headed Anchor Rods: ASTM F 1554, Grade 36, ASTM F 1554, Grade 55, weldable, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

G. Threaded Rods: ASTM A 36/A 36M, ASTM A 193/A 193M, Grade B7.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.3 PRIMER

A. Primer: Comply with Division 09 painting Sections and Division 09 Section "High-Performance Coatings."

B. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.

C. Primer: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, Pretensioned, Slip critical as required.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Splice members only where indicated.

E. Do not use thermal cutting during erection.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, Pretensioned, Slip critical as required.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.5 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. K-series steel joists.
2. KCS-type K-series steel joists.
3. Joist accessories.

1.2 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

C. Welding certificates.

D. Manufacturer certificates.

E. Mill Certificates: For bolts.

F. Field quality-control test and inspection reports.

G. Research/Evaluation reports.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by the Steel Joist Institute (SJI) to manufacture joists complying with SJI standard specifications and load tables.

B. SJI Specifications: Comply with SJI's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, SJI's "Specifications") that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

B. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

C. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

D. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.2 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists per construction drawings.

B. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

C. Do not camber joists.

2.3 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.4 JOIST ACCESSORIES

A. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

B. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.

C. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories. Apply 1 coat of shop primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel, bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with Research Council on Structural Connections' "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof deck.

1.2 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product certificates.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Research/Evaluation Reports: For steel deck.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc.
2. Canam Steel Corp.;The Canam Manac Group.
3. Consolidated Systems, Inc.
4. DACS, Inc.
5. D-Mac Industries Inc.
6. Epic Metals Corporation.
7. Marlyn Steel Decks, Inc.
8. New Millennium Building Systems, LLC.
9. Nucor Corp.; Vulcraft Division.
10. Roof Deck, Inc.
11. United Steel Deck, Inc.
12. Valley Joist; Division of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 STANDARD ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z275) zinc coating.

2. Deck Profile: As indicated (Type, WR, Wide Rib).
3. Profile Depth: As indicated on drawings.
4. Design Uncoated-Steel Thickness: As indicated 0.0358 inch, minimum.
5. Span Condition: As indicated, triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.
7. Provide Acoustical Type where specified as part of Alternate #4.

2.3 ACOUSTICAL ROOF DECK

A. Acoustical Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade [33 (230)], G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Basis of Design: Epic Metals Epicore “ER3.5A” or approved equal.

    b. Color: White.

2. Profile Depth: As Indicated "
3. Design Uncoated-Steel Thickness: As indicated
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.
6. Acoustical Perforations: Cellular deck units with manufacturer's standard perforated bottom.
7. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.

8. Acoustical Performance: NRC 0.95, tested according to ASTM C 423.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, requirements in this Section, and as indicated.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches (450 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches (305 mm) apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior non-load-bearing wall framing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   3. For cold-formed metal framing indicated to comply with design loads, include structural analysis data and shop drawing signed and sealed by a Professional Engineer in the State of Michigan.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product test reports.

D. Research reports.

1.4 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

C. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm), .0538 at Brick Veneer.
2. Flange Width: 1-5/8 inches (41 mm).
3. Limit deflection of wall studs to L/600 at brick veneer and L/360 at all other areas.

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: 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.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. 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: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

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 sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 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 and to 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.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity 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. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing 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.

I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches (406 mm).

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 infill studs and anchor to building structure.
4. Connect drift clips to cold-formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) 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.

a. Install solid blocking at centers indicated on Shop Drawings.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. 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.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 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.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Metal ladders.
3. Metal bollards.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.

1.2 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

B. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting".

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.

B. Steel Ladders:

1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
3. Rungs: 3/4-inch- (19-mm-) diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung.
6. Prime ladders, including brackets and fasteners, with zinc-rich primer.

2.8 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve.

C. Galvanize Metal Bollards.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Galvanize loose steel lintels located in exterior walls.

2.10 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 099123 "Interior Painting" unless otherwise indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING METAL BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink grout.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Wood blocking, cants, and nailers.
2. Wood furring.
3. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, [mark grade stamp on end or back of each piece] [or] [omit grade stamp and provide certificates of grade compliance issued by grading agency].
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

C. 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, as published by manufacturer, shall 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.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

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 floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:
   1. Concealed blocking.
   2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

   1. Blocking.
   2. Nailers.
   3. Cants.
   4. Furring.
   5. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

   1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
   2. Eastern softwoods; No. 2 Common grade; NeLMA.
   3. Northern species; No. 2 Common grade; NLGA.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.7 METAL FRAMING ANCHORS

A. Allowable design loads, as published by manufacturer, shall 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. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural wood cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
3. Shop finishing of architectural wood cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

1. Lumber for transparent finish, for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
3. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.3 QUALITY ASSURANCE

A. Submit certification stating that all wood veneer-faced architectural cabinets will comply with AWI's "Architectural Woodwork Quality Standards".

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOOD CABINETS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.

2.2 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Cabinet and Door and Drawer Front Interface Style: Flush overlay.

C. Wood for Exposed Surfaces:

1. Species: “Select White” Hard Maple.
   a. Veneer Face Grade: ‘A’.
2. Cut: Plain sliced.
3. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
4. Matching of Veneer Leaves: Book match.
5. Veneer Matching within Panel Face: Center-balance match.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Particleboard: ANSI A208.1, Grade M-2.
2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.4 PLASTIC LAMINATE CASEWORK, CABINET HARDWARE AND ACCESSORIES

A. General: Refer to specification Section 123216 – Manufactured Casework for plastic laminate casework requirements, cabinet hardware and accessory materials.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.6 FABRICATION

A. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.7 SHOP FINISHING

A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.

B. Transparent Finish:

1. Grade: Custom.
2. Finish: System - 5, conversion varnish.
3. Staining: Match Architect's sample.
4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

C. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

F. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

END OF SECTION 064113

SECTION 064600 - WOOD TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior standing and running trim.
   2. Shop finishing of wood trim.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

   1. Lumber for transparent finish, for each species and cut, finished on one side and one edge.

1.3 QUALITY ASSURANCE

A. Submit certification stating that all wood veneer-faced architectural cabinets will comply with AWI's "Architectural Woodwork Quality Standards".

1.4 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated. Refer to material finish / color schedule for species and locations.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

1. Wood Moisture Content for Interior Materials: 5 to 10 percent.

2.4 MISCELLANEOUS MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.5 FABRICATION

A. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.

B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

2.6 SHOP FINISHING

A. General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to end-grain surfaces.

C. Transparent Finish for Interior Trim:

1. Grade: Custom.
2. Finish: System - 5, conversion varnish.
3. Staining: Match Architect's sample.
4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

C. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

1. For shop-finished items, use filler matching finish of items being installed.

D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

END OF SECTION 064600

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Composite and non-composite polyisocyanurate foam-plastic board.
3. Mineral-wool blanket.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research reports.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards."

B. Extruded Polystyrene Board, Type X (for use in exterior walls): ASTM C 578, Type X, 15-psi (104-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company (The); “STYROFOAM Brand CAVITYMATE SC” Insulation or a comparable product by one of the following:

a. DiversiFoam Products.
b. Owens Corning.

2. Thickness: 2 inches.
3. Minimum R Value: 10.
4. Provide with manufacturer’s standard shiplap edge.

5. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

C. Extruded Polystyrene Board, Type VI (use underslab and interior footing perimeter): ASTM C 578, Type VI, 40-psi (276-kPa) minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company (The) ; STYROFOAM Brand HIGHLOAD 40 Insulation. or a comparable product by one of the following:

   a. DiversiFoam Products.
   b. Kingspan Insulation.
   c. Owens Corning.
   d. Soprema, Inc.

2. Thickness: 2 inches.
3. Minimum R Value: 10.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD

A. Composite Polyisocyanurate Board Insulation (for under metal standing seam roofing): ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.

1. Basis-of-Design Product: Subject to compliance with requirements, provide R-Max; “Nailable Base-3” or comparable product by one of the following:

   a. Atlas Roofing Corporation.
   b. Firestone Building Products.
   c. GAF Materials Corporation.
   d. Insulfoam LLC; a Carlisle company.

2. Type V, oriented strand board facer, 7/16 inch (11 mm) thick.

3. Nominal Thickness: 2.50 inches.

4. Minimum R Value: 12.0.

B. Polyisocyanurate Board Insulation (for under composite polyisocyanurate insulation): ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Rmax, Inc; “Multi-Max FA-3” or a comparable product by one of the following:

   a. Atlas Roofing Corporation.
   b. Firestone Building Products.
   c. GAF Materials Corporation.
   d. Insulfoam LLC; a Carlisle company.

2. Nominal Thickness: 1.50 inches.

3. Minimum R Value: 8.6.

2.3 MINERAL-WOOL BLANKETS (Sound Batt Insulation)

A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Thermafiber, Inc.; an Owens Corning company; FS-15 or a comparable product by one of the following:

a. Industrial Insulation Group, LLC (IIG-LLC).
b. Roxul Inc.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:
1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 ROOF INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and install composite board insulation for top layer.

C. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

2. Ensure that fasteners do not penetrate bottom layer of acoustical roof deck.

END OF SECTION 072100

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vapor-retarding, fluid-applied air barriers.

1.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.6 lbf/sq. ft., when tested according to ASTM E 2178.

C. Air/vapor barrier membrane components and accessories must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air-barrier assemblies.

1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

C. Product certificates.

D. Qualification data.

E. Product test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assemblies and incorporate air barrier membrane.

1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.

C. Preinstallation Conference: Conduct conference at Project Site.

1.5 WARRANTY

A. Provide manufacturer’s standard 10-year material warranty.

PART 2 - PRODUCTS

2.1 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

A. High-Build, Vapor-Retarding Air Barrier: synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 47 mils or thicker over smooth, void-free substrates.

1. Synthetic Polymer Type:

a. Basis-of-Design Product: Subject to compliance with requirements, provide Henry Company ; Air-Bloc 06WB or a comparable product by one of the following:

1) Carlisle Coatings & Waterproofing Inc.
2) Grace Construction Products; W.R. Grace & Co. -- Conn.
3) Rubber Polymer Corporation, Inc.
4) W. R. Meadows, Inc.

2. Physical and Performance Properties:
1) Air permeability: 0.001 CFM/ft^2 @ 1.6 lbs/ft^2. to ASTM E2178 and ASTM E283 and have no increased air leakage when subjected to a sustained wind load of 10.5 lbs/ft^2 for 1 hour and gust wind load pressure of 62.8 lbs/ft^2 for 10 seconds when tested at 1.6 lbs/ft^2 to ASTM E331,
2) Water vapor permeance: 0.02 perms to ASTM E96,
3) Wet Film Thickness: 90 mils,
4) Elongation: 2000% to ASTM D 412ACCESSORY MATERIALS

B. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

2.2 ACCESSORYMATERIALS

A. General: Accessory materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Self-Adhered transition membrane shall an SBS modified bitumen, self-adhering sheet membrane complete with thermoplastic film.

C. Alternate self-adhering membrane for all window and window sill flashings, door openings, inside and outside corners and other transitions shall be a SBS modified bitumen, self-adhering sheet membrane complete with surface layer of metallic aluminum film that many sealants adhere well to.

D. Liquid-applied flashing alternate to self-adhered flashing membranes for all window, door, MEP penetrations, inside/outside and dissimilar material connections shall be a moisture-curing single component STPe liquid-applied flashing compatible with a variety of substrates liquid and self-adhered air barrier membranes.

E. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

F. Primer: Adhesive for self-adhering membranes at all temperatures shall be a synthetic rubber based adhesive, quick setting.

G. Joint Treatment, penetration and termination Sealant shall be sealant recommended by air membrane barrier manufacturer for intended use; a moisture cure, medium modulus polymer modified sealing compound.

H. Insulation adhesive shall be recommended by air membrane barrier manufacturer for intended use; a synthetic, trowel applied, rubber based adhesive.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

F. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

G. Where curing compounds are used they must be clear resin based without oil, wax or pigments.

H. Do not proceed with application of air barrier membrane when rain is expected within 24 hours.

I. Condition materials to room temperature prior to application to facilitate handling.

J. New concrete should be cured for a minimum of 14 days and must be dry before air barrier membranes are applied.

K. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing and fastened into solid backing.

3.2 INSTALLATION

A. Install materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. JOINT TREATMENT

1. Seal joints ¼ inch and less between panels of exterior grade gypsum, gypsum sheathing, plywood, OSB or cementitious panels with joint treatment sealant over the face of the panel joint.
   a. Apply sealant along the butt joint and trowel smooth to form a continuous layer over the joint extending 1/2 inches on both sides to a uniform thickness of 1/8 inch thick.
2. Seal gaps and voids or irregular joints greater than ¼ inch between panels of exterior grade gypsum, gypsum sheathing, plywood, OSB or cementitious panels with a strip of self-adhered air/vapor barrier transition membrane lapped a minimum of 1-1/2 inches on both sides of the joint.
   a. Prime surfaces as per manufacturers' instructions and allow to dry.
   b. Align and position self-adhering air/vapor barrier transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
   c. Roll all laps and membrane with a counter top roller to ensure seal.
3. Alternately, joints not exceeding 1/8 inch can be sealed with yellow open weave glass fabric.
   a. Apply yellow open weave glass fabric centered over joint followed by a 1/8 inch (120mils) thick trowel application of air/vapor barrier membrane.
   b. Allow to dry prior to application of primary air/vapor barrier membrane.

C. INSIDE AND OUTSIDE CORNERS

1. Seal inside and outside corners of sheathing boards with a strip of self-adhering air/vapor barrier transition membrane extending a minimum of 3 inches on either side of the corner detail.
    a. Prime surfaces as per manufacturers' instructions and allow to dry.
    b. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
    c. Roll all laps and membrane with a counter top roller to ensure seal.

D. LIQUID-APPLIED FLASHING OPTION
1. Use for door and window openings, MEP penetrations and dissimilar material connections.
    a. Apply liquid flashing to all material joints and tool smooth.
    b. Apply liquid flashing in a serpentine fashion to the entire window opening and tool smooth to a minimum 25 mils wet film thickness. Spread material to cover the inside of rough openings and extend 4 inches onto adjacent surfaces. Create a slight positive slope towards the exterior of sill conditions by applying more material to the interior side of sills to create a taper towards the exterior while maintaining a minimum 25 mils wet film thickness.
    c. Apply liquid flashing to MEP penetrations with a maximum of ½ inch annular space. Extend liquid flashing a minimum 4 inches onto penetrating item and surrounding surfaces to a minimum of 25 mils dry film thickness.
    d. Apply liquid flashing to inside/outside corners and dissimilar material connections. Extend a minimum 4 inches onto adjacent surfaces a minimum of 4 inches and a minimum wet film thickness of 25 mils dry film thickness.
    e. Apply fluid-applied membrane air barrier onto liquid flashing a minimum of 2 inches.

E. TRANSITON AREAS
1. Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials as indicated in drawings with self-adhered air/vapor barrier transition membrane.
    a. Prime surfaces as per manufacturers' instructions and allow to dry.
    b. Align and position self-adhering air/vapor barrier transition membrane, remove protective film and press firmly into place. Provide minimum 3 inch lap to all substrates.
    c. Ensure minimum 2 inch overlap at all end and side laps of membrane.
    d. Roll all laps and membrane with a counter top roller to ensure seal.

F. WINDOWS AND ROUGH OPENINGS
1. Window flashing materials are to be installed per the project construction documents or per industry standards including but not limited to ASTM E2112. Sheet or liquid applied window flashing membrane shall extend a minimum of 3" onto face of wall. Sheet or liquid applied flashing membrane shall extend into the rough opening per the project construction documents and to sufficiently provide continuity between the fenestration and field of wall.

G. PRIMARY AIR/VAPOR BARRIER
1. Apply by spray or flat trowel a complete and continuous unbroken film of liquid air/vapor and rain barrier membrane to an approximate wet film thickness of 80 mils (47 mils dry).
    a. For temperatures below 40 degrees F apply one component glycol-based air/vapor barrier membrane at a rate recommended by manufacturer.
2. Spray-apply or trowel around all projections and penetrations ensuring a complete and continuous air barrier membrane.
3. Allow air barrier membrane to dry as per manufacturers recommendations prior to placement of insulating materials.

H. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

I. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

K. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 47 mils, applied in one or more equal coats.

L. Do not cover air barrier until it has been tested and inspected by testing agency.

M. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 INSTALLATION OF INSULATION

A. A. Coordinate with Cavity Wall Insulation Section 072100 for insulating materials.

B. Apply insulation adhesive in a serpentine pattern over the air barrier membrane.
1. Dab Method: Apply walnut-sized dabs of insulation adhesive spaced 6 inches on center to substrate. Apply insulation using sufficient hand pressure to compress dabs up to 2 inches in diameter.
2. Bead Method: Apply ¼ inch beads 6 inches on center in a serpentine pattern.

C. Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements.

C. Tests: As determined by testing agency from among the following tests:

1. Air-barrier dry film thickness.
2. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
3. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783.
4. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Remove masking materials after installation.

C. Damp substrates must not be inhibited from drying out. Do not expose the backside of the substrate to moisture or rain.

D. Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane. Drying time varies depending on temperature and relative humidity. Protect air barrier Work against wet weather conditions for a minimum of 24 hours.

E. Air barrier membranes are not designed for permanent exposure. Good practice calls for covering as soon as possible.

END OF SECTION 072726

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes standing-seam metal roof panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 1680 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

F. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels (MRP-1): Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Peterson Aluminum Corp. “Tite-Loc” metal roof system or equal product by one of the following:

a. AEP-Span.
b. Architectural Building Components.
c. Architectural Metal Systems.
d. Architectural Roofing and Siding, Inc.
e. Berridge Manufacturing Company.
f. CENTRIA Architectural Systems.
g. Copper Sales, Inc.
h. Fabral.
i. Metal-Fab Manufacturing, LLC.
j. Metecno-Morin; Division of Metecno Inc.
k. Steelox Systems, L.L.C.
l. United Steel Deck Inc.; Subsidiary of Bouras Industries Inc

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 0.034 inch (0.86 mm).
b. Exterior Finish: Two-coat fluoropolymer.

c. Color: Refer to Material Finish / Color Schedule section 000200.

3. Clips: High Performance clip to accommodate thermal movement.

a. Material: 0.064-inch- (1.63-mm-) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.

4. Joint Type: As standard with manufacturer.
5. Panel Coverage: 16 inches.
6. Panel Height: 2.0 inches.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils (1.02 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

3. Basis-of-Design Product: Subject to compliance with requirements, provide Grace Construction Products; W.R. Grace & Co. -- Conn.; “Grace Ice and Water Shield HT” or a comparable product by one of the following:

a. Carlisle Residential; a division of Carlisle Construction Materials.
b. Drexel Metals.
c. Henry Company.
d. Kirsch Building Products, LLC.
e. Owens Corning.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters and Downspouts: Formed from same material as roof panels according to SMACNA's "Architectural Sheet Metal Manual." Finish to match roof fascia and rake trim.

E. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch (1.2-mm) nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch- (1.52-mm-) nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below and on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.3 METAL PANEL INSTALLATION

A. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Watertight Installation:

a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.

c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074113.16

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type and color of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS (MWP-#)

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners. Include accessories required for weathertight installation.

1. Basis of Design Product: Subject to compliance with requirements, provide product indicated in Metal Wall Panel Types specified below or an approved equal by one of the following:

a. Architectural Building Components.
b. Architectural Metal Systems.
c. Berridge Manufacturing Company.
d. CENTRIA Architectural Systems.
e. Firestone Building Products; Una-Clad
f. Metal-Fab Manufacturing, L.L.C.

2. Metal Wall Panel (MWP-1, MWP-2):
a. Peterson Aluminum Corporation 'PAC Precision Series HWP Panel'.
b. Panel Height: 12-inch
c. Panel Depth: 7/8-inch
d. Panel Length: Continuous lengths without seams.
e. Material: Metallic-Coated Steel Sheet: Zinc-coated (galvanized) 24-gauge steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
f. Exterior Finish: Two-coat fluoropolymer.
g. Color: Refer to Material Finish / Color Schedule section 000200.

3. Metal Wall Panel (MWP-3):
a. Peterson Aluminum Corporation 'Flush Wall Panel'.
b. Panel Height: 12-inch
c. Panel Depth: 1-inch
d. Panel Length: Continuous lengths without seams.
e. Material: Metallic-Coated Steel Sheet: Zinc-coated (galvanized) 22-gauge steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
f. Exterior Finish: Two-coat fluoropolymer.
g. Color: Refer to Material Finish / Color Schedule section 000200.

2.4 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Subgirts: Manufacturer's standard C or Z-shaped adjustable sections, 0.064-inch (1.63-mm) nominal thickness.

C. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.

D. Base or Sill Channels: 0.079-inch (2.01-mm) nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated.
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

G. Z-Shaped Furring: With slotted or nonslotted adjustable web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated and to adjust for wall tolerances.

1. Nominal Thickness: As required to meet performance requirements.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: [AAMA 621] [AAMA 2605]. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
3. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Division 7 Section "Building Insulation."

1. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Attach furring members to substrate with screws spaced 24 inches (610 mm) o.c.

3.3 METAL PANEL INSTALLATION

A. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

B. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION 074213.13

SECTION 074213.16 - METAL PLATE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal plate wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type and color of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 METAL PLATE WALL PANELS (MWP-#)

A. Metal Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Basis of Design Product: Subject to compliance with requirements, provide product indicated in Metal Wall Panel Types specified below or an approved equal by one of the following:

    a. ALCOA Architectural Products; Reynobond.
    b. Architectural Specialty Products, Inc.
    c. CENTRIA Architectural Systems.
    d. Firestone Building Products; Una-Clad.
    e. Industrial Building Panels, Inc.

2. Metal Wall Panel (MWP-4):
    a. Peterson Aluminum Corporation 'PAC – 3000 AP'.
    b. Panel Height: As indicated on drawings.
    c. Panel Depth: 1-inch
    d. Panel Length: As indicated on drawings.
    e. Material: Tension-leveled, smooth aluminum sheet, ASTM B 209 (ASTM B 209M), 0.125 inch (3.18 mm) thick.
    f. Exterior Finish: Two-coat fluoropolymer.
    g. Color: Refer to Material Finish / Color Schedule section 000200.

B. Attachment Assembly: Manufacturer's standard extruded aluminum.

1. Provide internal drainage system that allows individual panels to be installed and removed without disturbing adjacent panels.
2. Include manufacturer's standard subgirts, perimeter extrusions, tracks, and drainage channels, panel stiffeners, panel clips and anchor channels.
3. Alignment Pins: Stainless steel.

2.3 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Subgirts: Manufacturer's standard C or Z-shaped adjustable sections, 0.064-inch (1.63-mm) nominal thickness.

C. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.

D. Base or Sill Channels: 0.079-inch (2.01-mm) nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated.

3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

G. Z-Shaped Furring: With slotted or nonslotted adjustable web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated and to adjust for wall tolerances.

1. Nominal Thickness: As required to meet performance requirements.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C 920; as recommended in writing by metal panel manufacturer.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Metal Plate Wall Panels: Fabricate panels with panel stiffeners as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:

1. Length and Width: Plus or minus 0.032 inch (0.81 mm) up to 48 inches (1219 mm); 0.064 inch (1.63 mm) more than 48 inches (1219 mm).
2. Diagonal: Plus or minus 0.1875 inch (4.76 mm).

3. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch (4.76 mm) maximum.
4. Thickness: Plus or minus 0.008 inch (0.2 mm).
5. Squareness: 0.1875-inch (4.76-mm) difference between diagonal measurements.
6. Camber: 0.032 inch (0.81 mm).

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

A. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

B. Attachment Assembly, General: Install attachment assembly required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

C. Installation: Attach metal plate wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant to match the metal wall panels. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."

D. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

E. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set

units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.2 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Division 7 Section "Building Insulation."

1. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Attach furring members to substrate with screws spaced 24 inches (610 mm) o.c.

3.3 METAL PLATE WALL PANEL INSTALLATION

A. Attachment System, General: Install attachment system required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

A. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
4. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal plate wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION 074213.16

SECTION 074213.53 - METAL SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal soffit panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type and color of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL SOFFIT PANELS (MSP-#)

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

1. Basis of Design Product: Subject to compliance with requirements, provide product indicated in Metal Soffit Panel Types specified below or an approved equal by one of the following:

a. Architectural Building Components.
b. Architectural Metal Systems.
c. Berridge Manufacturing Company.
d. CENTRIA Architectural Systems.
e. Firestone Building Products; Una-Clad
f. Metal-Fab Manufacturing, L.L.C.

2. Metal Soffit Panel (MSP-1):
a. Peterson Aluminum Corporation ‘Soffit Panels - Flush’.
b. Panel Width: 12-inch

c. Panel Depth: 1-inch
d. Panel Length: Continuous lengths without seams.
e. Material: Aluminum Sheet: Coil-coated .032 sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
f. Exterior Finish: Two-coat fluoropolymer.
g. Color: Refer to Material Finish / Color Schedule section 000200.
h. Provide vented panels as indicated on drawings.

2.3 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Subgirts: Manufacturer's standard C sections, 0.064-inch (1.63-mm) nominal thickness.

C. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.

D. Base or Sill Channels: 0.079-inch (2.01-mm) nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated.
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

5. Nominal Thickness: As required to meet performance requirements.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: [AAMA 621] [AAMA 2605]. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
3. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.2 METAL SOFFIT PANEL INSTALLATION

A. Metal Soffit Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

B. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel

installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION 074213.53

SECTION 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered polyvinyl-chloride (PVC) roofing system.
2. Roof insulation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation, and fasteners for roofing system from manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

B. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
1. Roofing system shall be designed to accommodate ASCE 7-10 windspeeds of 115 mph; risk category II.

D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

E. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.86 and an emissivity of not less than 0.82 when tested according to CRRC-1.

F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 PVC ROOFING

A. PVC Sheet: ASTM D 4434/D 4434M, Type III, fabric reinforced and fabric backed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville; a Berkshire Hathaway company; “JM PVC-60 Mil” or a comparable product by one of the following:

    a. Carlisle SynTec Incorporated.
    b. Duro-Last Roofing, Inc.
    c. Flex Membranes International.
    d. GAF Materials Corporation.

2. Thickness: 60 mils (1.5 mm), nominal.
3. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.

C. Bonding Adhesive: Manufacturer's standard.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

E. Miscellaneous Accessories: Provide metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville; a Berkshire Hathaway company; “Tapered ENRGY 3” or a comparable product by one of the following:

    a. Atlas Roofing Corporation.
    b. Carlisle SynTec Incorporated.
    c. Firestone Building Products.
    d. GAF Materials Corporation.
    e. Insulfoam LLC; a Carlisle company.
    f. Rmax, Inc.

B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof cover board to substrate or to another insulation layer.

C. Cover Board: ASTM C 1289, Type II, Class 4, Grades 1, 2 and 3, high density polyisocyanurate board with mineral coated fiber glass reinforced facers, 1/4 inch (6 mm) thick.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville; a Berkshire Hathaway company; “Invinsa Roof Board” or a comparable product by one of the following:

a. Atlas Roofing Corporation.
b. Carlisle SynTec Incorporated.
c. Firestone Building Products.
d. GAF Materials Corporation.
e. Insulfoam LLC; a Carlisle company.
f. Rmax, Inc.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.2 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Install tapered insulation under area of roofing to conform to slopes indicated.

C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

D. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

E. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck.

1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
2. Set cover board in manufacturer recommended adhesive, firmly pressing and maintaining cover board in place.

3.3 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

1. Install sheet according to ASTM D 5036.

B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

D. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.

E. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

F. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.4 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.5 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.6 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets and counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed steep-slope roof sheet metal fabrications.
5. Cast Iron downspout drainage boot.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

B. Preinstallation Conference: Conduct conference at Project site.

C. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

D. Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including fascia, fascia trim, metal panel and other detailed accessories, approximately 10 feet (3.0 m) long.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; 2B (bright, cold rolled) finish.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
   1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
   2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

      a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
      b. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

   2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
   3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 MANUFACTURED REGLETS

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

1. Material: Stainless steel, 0.019 inch (0.48 mm) thick.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Fabricate from the following materials:
a. Galvanized Steel: 0.022 inch (0.56 mm) thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.

1. Fabricate from the Following Materials:
a. Galvanized Steel: 0.034 inch thick (22 gauge).

B. Base Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick (24 gauge).

C. Counterflashing and Flashing Receivers: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch (0.71 mm) thick (24 gauge).

E. Roof-Drain Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.9 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

B. Valley Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch (0.71 mm) thick.

C. Drip Edges: Fabricate from the following materials:
1. Stainless Steel: 0.016 inch (0.40 mm).

D. Eave, Rake and Ridge Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

2.10 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, at shelf angles, and where indicated. Fabricate

discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high, end dams where flashing is discontinuous. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

2.11 CAST IRON DOWNSPOUT DRAINAGE BOOT

A. Cast Iron Downspout Drainage Boot: Provide “Zurn” cast iron downspout drainage boot at all downspout locations. Drainage boot to have integral cleanout access port and cast iron strap for screw attachment to vertical wall surface. Choose item below, based on downspout sizes.
1. Zurn “Z192-CA-G”
   a. Size: 4”x3”x24” deep.
   b. Galavanized cast iron.

2. Zurn “Z191-CA-G”
   a. Size: 5”x4”x24” deep.
   b. Galvanized cast iron.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet (15.24 m) apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

1. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch (600-mm) centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with sealant.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies."

C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof hatches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

B. Shop Drawings: For roof accessories.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides and integrally formed deck-mounting flange at perimeter bottom.

B. Basis of Design: Subject to compliance with requirements, provide “Bilco Thermally Broken Roof Hatch E-50-TB” or approved equal.

C. Type and Size: Single-leaf lid, 36 by 36 inches (900 by 900 mm).

D. Performance characteristics:
   1. Cover and curb shall be thermally broken to prevent heat transfer between interior and exterior surfaces.
   2. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m^2) with a maximum deflection of 1/150th of the span or 20 psf (97kg/m^2) wind uplift.

3. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
4. Operation of the cover shall not be affected by temperature.
5. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

E. Hatch Material: Aluminum sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
2. Finish: Mill.

F. Cover: Shall be 11 gauge (2.3mm) aluminum with a 5" (127mm) beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. Cover shall have a heavy extruded EPDM rubber gasket bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

G. Cover insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 18, fully covered and protected by an 18 gauge (1mm) aluminum liner.

H. Curb: Shall be 12" (305mm) in height and of 11 gauge (2.3mm) aluminum. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. The curb shall be formed with a 5-1/2" (140mm) flange with 7/16" (11mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

I. Curb insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 18.

J. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.

K. Hardware
1. Heavy stainless steel pintle hinges shall be provided.
2. Cover shall be equipped with a spring latch with interior and exterior turn handles.
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

L. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches (1060 mm) above finished roof deck.
3. Material: Steel tube.

4. Post: 1-5/8-inch- (41-mm-) diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat

    a. Color: As indicated by manufacturer's designations.

2.2 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.

B. Steel Tube: ASTM A 500/A 500M, round tube.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

C. Underlayment:

1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
3. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

C. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

B. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 077253 - SNOW GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rail-type, seam-mounted snow guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

1. Include calculation of number and location of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.

C. Samples.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Structural Performance:

1. Snow Loads: 30 psf.

C. Seam-Mounted, Rail-Type Snow Guards:

1. Basis-of-Design Product: Subject to compliance with requirements, provide S-5! Attachment Solutions; Metal Roof Innovations, Ltd.; “Color Guard” or a comparable product by one of the following:

a. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.

b. LMCurbs.
c. Sno-Gem, Inc.
d. Snow Management Systems.

2. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with one rail with color-matching inserts of material and finish used for metal roofing.
3. Material and Finish: Aluminum; mill.
4. Components:
   a. Clamps: Manufactured from 6061-T6 aluminum extrusions conforming to ASTM B221 or aluminum castings conforming to ASTM B85 and to AA Aluminum Standards and Data.
      1) Type: As recommended by manufacturer for standing seam roofing type.
   b. Set screws: 300 Series stainless steel, 18-8 alloy, 3/8 inch diameter, with round nose point.
   c. Attachment bolts: 300 Series stainless steel, 18-8 alloy, 8 mm or 10 mm diameter, hex flange bolt.
   d. Cross Members: Manufactured from 6061-T6 or 6005-T5 alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data.
      1) Receptacle in face to receive color-matched metal strips.
      2) Provide splice connectors ensuring alignment and structural continuity at end joints.
   e. Color Strips: Same material and finish as roof panels; obtained from roof panel manufacturer.
   f. Snow and Ice Clips: Aluminum, with rubber foot, minimum 3 inches wide.
      1) Type: As recommended to accommodate standing seam height and type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer.

B. Attachment for Standing-Seam Metal Roofing:

1. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
2. Seam-Mounted, Rail-Type Snow Guards: Aluminum clamps attached to vertical ribs of standing-seam metal roof panels.

C. Snow and Ice Clips:
1. Install at each panel, between standing seams in roofing. Attach to cross members.

END OF SECTION 077253

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Latex joint sealants.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates for both exterior and interior applications.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Compatibility and adhesion test reports.

1.4 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.

1.5 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

C.

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. BASF Corporation-Construction Systems.
b. Pecora Corporation.
c. Polymeric Systems, Inc.
d. Sika Corporation.
e. Tremco Incorporated.

B. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.

a. BASF Corporation-Construction Systems.
b. Pecora Corporation.
c. Polymeric Systems, Inc.
d. Sika Corporation.
e. Tremco Incorporated.

C. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.

a. BASF Corporation-Construction Systems.
b. Pecora Corporation.
c. Polymeric Systems, Inc.
d. Sika Corporation.
e. Tremco Incorporated.

D. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

a. BASF Corporation-Construction Systems.
b. Pecora Corporation.
c. Polymeric Systems, Inc.
d. Sika Corporation.
e. Tremco Incorporated.

2.4 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

a. BASF Corporation-Construction Systems.
b. Pecora Corporation.
c. Polymeric Systems, Inc.
d. Sika Corporation.
e. Tremco Incorporated.

B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

a. BASF Corporation-Construction Systems.
b. Pecora Corporation.
c. Polymeric Systems, Inc.
d. Sika Corporation.
e. Tremco Incorporated.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. Soudal USA.
d. Tremco Incorporated.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation-Construction Systems.
b. May National Associates, Inc.; a subsidiary of Sika Corporation.
c. Pecora Corporation.
d. Tremco Incorporated.

2.7 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint

substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
      a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
   2. Remove laitance and form-release agents from concrete.
      a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

F. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Isolation and contraction joints in cast-in-place concrete slabs.
   b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Control and expansion joints in unit masonry.
   b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 100/50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
   a. Custom color to be used at brick veneer.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Control and expansion joints in tile flooring.
   b. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Tile control and expansion joints.
c. Vertical joints on exposed surfaces of unit masonry, walls and partitions.
d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Owner from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Owner from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Owner from manufacturer's full range of colors

END OF SECTION 079200

SECTION 081213 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal frames.

B. Related Requirements:

1. Section 081416 "Flush Wood Doors" for wood doors installed in hollow-metal frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include elevations, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld International, LLC.
2. Ceco Door; ASSA ABLOY.
3. Curries Company; ASSA ABLOY.
4. Deansteel Manufacturing Company, Inc.
5. Kewanee Corporation (The).
6. Republic Doors and Frames.
7. Steelcraft; an Allegion brand.

2.2 INTERIOR FRAMES

A. Heavy-Duty Frames: SDI A250.8, Level 2.

1. Physical Performance: Level B according to SDI A250.4.

2. Frames:

   a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch.
   b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
   c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.3 BORROWED LITES

A. Hollow-metal frames of uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).

B. Construction: Full profile welded.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing).

I. Glazing: Comply with requirements in Section 088000 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelite and Transom Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing.
    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c.

6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.

C. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce frames to receive nontemplated, mortised, and surface-mounted hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

D. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on secure side of interior frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

2.8 ACCESSORIES

A. Mullions: Join to adjacent members by welding.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   b. Install frames with removable stops located on secure side of opening.
   c. Install door silencers in frames before grouting.
   d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081213

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.

B. Related Requirements:
1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide Pre-finished wood doors by Marshfield Door Systems, Inc. or equal product by one of the following:

1. Algoma Hardwoods, Inc.
2. Ampco, Inc.
3. Buell Door Company Inc.
4. Eggers Industries
5. Graham; an Assa Abloy Group company.
6. Ideal Architectural Doors & Plywood.
7. Mohawk Flush Doors, Inc.; a Masonite company.
8. Oshkosh Architectural Door Company.
9. Vancouver Door Company.
10. VT Industries Inc.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards and WDMA I.S.1-A, "Architectural Wood Flush Doors."

B. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: Public restrooms, multi-purpose rooms, study rooms and where indicated.

C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Select white birch.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Core: Particleboard.
7. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors that are indicated to receive transparent finish.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 081416

SECTION 083326 – SIDE FOLDING SLIDING GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes open-curtain side-folding sliding grilles.

B. Related Section:

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Samples: For each exposed product and for each color and texture specified.

D. Maintenance data.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

2.2 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.

B. Top Track: Manufacturer's standard continuous extruded aluminum track, finished to match grille.

C. Vertical Upright Members: Manufacturer’s standard top and bottom locking extruded aluminum posts, finished to match grille.

2.3 POCKET DOOR AND ACCESSORIES

A. General: Form 12-gauge sheet metal pocket door to entirely enclose folded curtain at storage pocket when folding grille is retracted. Roll and reinforce edges for stiffness.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Cornell Iron Works, inc.: Pocket Door for Side Folding Grille or comparable product by one of the following:

      a. ACME Rolling Doors.
      b. Cookson Company.
      c. Dynamic Closures Corp.
      d. Overhead Door Corporation.

B. Mounting Frame: Manufacturer's standard 2-inch wide mounting frame designed to support pocket door and conceal entire pocket width. Factory fabricated from ASTM A 36 structural-steel shapes, hot-dip galvanized per ASTM A 123; fastened to floor and structure above grille; to be built into wall construction with a 5/8-inch projection from wall; and complete with anchors, connections, and fasteners.

C. Hinges: Continuous piano hinge designed to support pocket door, finished to match pocket door.

D. Lock: 1 3/4” security mortise cylinder keyed to match building.

E. Operation Cycles: Not less than 50,000.

F. Door Finish: Powder coat finish as selected from standard 180 colors.

2.4 LOCKING DEVICES

A. Drop Bolt Lock: Fabricate with drop-locking bolts to engage sleeves in floor and track for locking by lock cylinder, located on both leading and trailing edge posts, operable from secure side.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage sleeves in floor and track.

1. Lock Cylinders: Provide cylinders standard with manufacturer.
2. Keys: Two for each cylinder.

C. Chain Lock Keeper: Suitable for padlock.

2.5 MANUAL GRILLE OPERATORS

A. Equip grille with manufacturer's recommended manual grille operator unless another type of grille operator is indicated.

2.6 OPEN-CURTAIN GRILLE ASSEMBLY

A. Open-Curtain Grille: Overhead coiling grille with a curtain having a network of horizontal rods that interconnect with vertical links.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Cornell Iron Works, inc.: Side Folding Grille: VisionGlide Model ESG-30 or comparable product by one of the following:

a. ACME Rolling Doors.
b. Cookson Company.
c. Dynamic Closures Corp.
d. Overhead Door Corporation.

B. Operation Cycles: Not less than 50,000.

C. Grille Curtain Material: Aluminum.

D. Grille Curtain Link Spacing: 9-inch

E. Grille Curtain Pattern: Straight.

F. Locking Devices: Equip grille with locking device assembly.

G. Grille Finish: Clear anodized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install side-folding sliding grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion. Lubricate bearings and sliding parts as recommended by manufacturer.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 083326

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes electrically operated sectional doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Structural Performance, Interior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.
2. Testing: According to ASTM E 330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.

2.2 DOOR ASSEMBLY

A. Full-Vision Aluminum Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; 511 Series Aluminum Door or comparable product by one of the following:
1. Crawford Door Company
2. Martin Door Manufacturing
3. Raynor Door Company
4. Wayne-Dalton Corp.

C. Operation Cycles: Door components and operators capable of operating for not less than 20,000.

D. Aluminum Sections: Full vision.

E. Track Configuration: High-lift track.

F. Windows: As indicated on drawing Door Type elevations.

G. Locking Devices: Equip door with slide bolt for padlock and chain lock keeper.

H. Electric Door Operator:

1. Usage Classification: Standard duty, up to 60 cycles per hour.
2. Operator Type: Model RSX 3/4 hp
3. Operator Mounting: Trolley-type (concealed above accessible ceiling).
4. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.4 m) or lower.
5. Motor Exposure: Interior, clean and dry.
6. Emergency Manual Operation: Push-up.

7. Obstruction-Detection Device: Electric sensor edge on bottom bar.
8. Control Station: As indicated on drawings.

I. Door Finish:

1. Aluminum Finish: Clear anodized (all surfaces).

2.3 ALUMINUM DOOR SECTIONS

A. Sections: Extruded-aluminum stile and rail members with dimensions and profiles as indicated on Drawings; members joined by welding or with concealed, aluminum or nonmagnetic stainless-steel through bolts, full height of door section; and with meeting rails shaped to provide a weather-resistant seal.

1. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
2. Provide reinforcement for hardware attachment.

B. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with glazing as indicated on Door Type elevations set in neoprene glazing channel and with removable extruded aluminum stops.

2.4 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.

1. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device.

B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

C. Windows: Number of window units, type, size, and in arrangement indicated. Provide removable stops of same material as door-section frames.

2.5 HARDWARE

A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty, galvanized-steel hinges at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails.

C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Provide 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.

D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.6 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

B. Chain Lock Keeper: Suitable for padlock.

C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.7 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.

B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.

C. Cables: Galvanized-steel, multistrand, lifting cables.

D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.

E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.8 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.

1. Electrical Characteristics:

a. Phase: Single phase.
b. Volts: 115 V.
c. Hertz: 60.

2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.

E. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom section. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Self-Monitoring Type: Four-wire configured device designed to interface with door-operator control circuit to detect damage to or disconnection of sensor edge.

F. Control Station: Keyed switch control station in fixed location with momentary-contact positions labeled "Open", “Close” and "Stop" that require sustained or constant-pressure to operate.

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

G. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).

H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

J. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks: Install to retract door entirely above ceiling and out of sight. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

E. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

F. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior storefront framing.
2. Storefront framing for window walls.
3. Storefront framing for punched openings.
4. Exterior manual-swing entrance doors and door-frame units.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each exposed finish required.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer and installer agree to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: 30 psf.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 11 feet 8-1/4 inches (3.6 m) or 1/175 times span, for spans less than 11 feet 8-1/4 inches (3.6 m).

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2. Entrance Doors:
a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 35 as determined according to NFRC 500.

I. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 4.

1. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 MANUFACTURERS

A. Storefront: Basis-of-Design Product: Subject to compliance with requirements, provide Tubelite Inc. “T14000 I/O Series”, 2” x 4 ½” storefront framing or comparable product by one of the following:
1. Arch Aluminum & Glass Co., Inc.
2. EFCO Corporation.
3. Kawneer North America; an Alcoa company.
4. United States Aluminum.
5. YKK AP America Inc.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally improved.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Sill Receptor: Manufacturer’s standard thermally broken, extruded aluminum sill receptor to allow system in internally drain. Provide Tubelite T-14259 or equal.

E. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

    a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
    b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
    c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
    d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

    a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
    b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
    c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's heavy duty glazed entrance doors. Tubelite Inc. “Medium Stile Entrance” door or equal by manufacturers listed under Paragraph 2.2.A.

1. Door Construction: 1-3/4 inch overall thickness, with minimum 0.188-inch- (4.8-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

    a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: 6 inch stiles, 6” top rail and 10” bottom rail.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide non-removable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Provide and install hardware as specified in Section 087100 "Door Hardware”.

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

a. Perform a minimum of two tests in areas as directed by Architect.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 084115 - FIBERGLASS REINFORCED POLYESTER (FRP) DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced polyester (FRP) flush doors.

1.02 RELATED SECTIONS

A. Section 079200 - Joint Sealants: Perimeter sealant and back-up materials.

B. Section 084113 – Aluminum Framed Entrances and Storefronts

D. Section 087100 - Door Hardware: Hardware items other than those specified in this section.

1.03 SYSTEM PERFORMANCE – FRP FLUSH DOORS

A. Provide door assemblies that have been designed and fabricated to comply with requirements for system performance characteristics listed below, as demonstrated by testing manufacturer's corresponding stock systems according to test methods designated.

B. Thermal Transmission (exterior doors); U-value of not more than 0.09 (BTU/Hr. x sf x degrees F.) per AAMA 1503.01.

C. Flame Spread/Smoke Developed: Provide FRP doors and panels with the following ratings in accordance with ASTM E 84-79a: Flame Spread: Exterior faces not greater than 145 (Class C); interior faces not greater than 10 (Class A). Smoke Developed: Exterior faces not greater than 345 (Class C); interior faces not greater than 320 (Class A).

D. Additional Criteria: Provide FRP doors and panels with the following performance:
ASTM D 256 - nominal value of 13.5
ASTM D 1242 - nominal value of .23 percent
ASTM D 570 - nominal value of .20 to .40 percent
ASTM D 2583 - nominal value of 50

1.04 SYSTEM DESCRIPTION – ALUMINUM STOREFRONT FRAMING SYSTEMS

A. Performance Requirements: Refer to section 08410 for requirements.

1.05 QUALITY ASSURANCE

A. Standards: Comply with the requirements and recommendations in applicable specification and standards by NAAMM and AAMA, including the terminology definitions and specifically including the "Entrance Manual" by NAAMM, except to the extent more stringent requirements are indicated.

B. Installer’s Qualifications: Entrances and storefront shall be installed by a firm that has not less than

five (5) years successful experience in the installation of systems similar to those required.

C. Field Measurement: Field verify all information prior to fabrication and furnish all materials to suit.

D. Regulation and Codes: Comply with the current edition in force at the project location of all local, state and federal codes and regulations, including the current Americans with Disabilities Act.

1.06 SUBMITTALS

A. Product Data: Submit Manufacturer's product data, specifications and instructions for each type of door.

1. Include details of core, stile and rail construction, trim for lites and all other components.
2. Include details of door hardware mounting.

B. Submit shop drawings for the fabrication and installation of the doors and frames, and associated components. Details to be shown full scale. Include glazing details and door hardware schedule.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to jobsite in their original, unopened packages with labels intact. Inspect materials for damage and advise manufacturer immediately of any unsatisfactory materials.

B. Package door assemblies in individual cartons protected so no portion of the door has contact with the outer shell of the container.

1.08 PROJECT WARRANTY

A. Provide a written warranty signed by manufacturer, installer and contractor, agreeing to replace, at no cost to the Owner, any doors, frames or factory hardware installation which fail in materials or workmanship, within the warranty period. Failure of materials or workmanship includes: excessive deflection, faulty operation of entrances, deterioration of finish, or construction in excess of normal weathering and defects in hardware installation.

1. Fiber Reinforced Plastic (FRP) door warranty period – ten (10) years.
2. Aluminum Storefront, refer to Section 084113.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Fiber Reinforced Polyester Door Manufacturer: Subject to compliance with requirements, provide Special-Lite, Inc. “Flush Door SL-17” or equal product by the following:

1. Cline Aluminum Doors, Inc.
2. Curries
3. Oshkosh Door Company.

4. Vale Doors.

2.02 MATERIALS AND ACCESSORIES

A. Fasteners: Aluminum non-magnetic stainless steel or other non-corrosive metal fasteners, guaranteed by the manufacturer to be compatible with the doors, frames, stops, panels, hardware, anchors and other items being fastened, without exposed fasteners.

B. Compression Weatherstripping: Provide the manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with ASTM D 2287.

C. Sliding Weatherstripping: Provide the manufacturer's standard replaceable weatherstripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.

2.03 FABRICATION

A. Sizes and Profiles: The required sizes for door and frame units, and profile requirements are shown on the drawings.

B. Coordination of Fabrication: Field measure before fabrication, and show recorded measurements on final shop drawings.

C. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to assembly. Remove burrs from cut edges, and ease edges and corners to a radius of approximately 1/64".

D. No welding of doors or frames is acceptable.

E. Maintain continuity of line and accurate relation of planes and angles. Secure attachments and support at mechanical joints, with hairline fit at contacting members.

E. Attachment of all hardware shall be made using machine screws which are supplied by the manufacturer.

F. All holes shall be drilled and tapped using the recommended drill size for the tap required.

G. Door attachment points shall be minimum of 1/8" thickness.

H. Where hardware is to be attached to frame stop (Example: exit device strike, door closer shoe, O.H. stop & Etc.) a piece of solid bar stock aluminum sized to fill the frame stop void x 18" long shall be securely attached to the frame tube.

2.04 FIBERGLASS REINFORCED POLYESTER (FRP) FLUSH DOORS

A. Materials and Construction

1. Construct 1-3/4" thickness doors of 6063-T5 aluminum alloy stiles and rails - minimum 6" width top, 5” width lock side and 3” bottom and hinge rail . Provide full width mortise and tendon joints, tie rods through extruded splines top and bottom not approved.125" tubular shaped stiles and rails reinforced to accept hardware as specified. Furnish integral reglets to accept face sheet to permit a flush appearance. Color: Refer to Material Finish / Color Schedule Section 000200.
2. Extrude top and bottom rail legs for interlocking continuous rail rigidity weather bar and reinforcement for door hardware. Lock face sheet material in place with extruded interlocking edges to be flush with aluminum stiles and rails.
3. Door face sheeting .120" thickness fiberglass reinforced polyester. With pebble-like embossed pattern.
4. Core of Door Assembly: Poured in place polyurethane foam (slip in core will not be accepted), minimum five pounds per cubic foot density, with a minimum ”R" value of 11. Meeting stiles on pairs of doors, and weather bars with nylon brush weather stripping.
5. Pre-machine doors in accordance with templates from the specified door hardware manufacturers and approved hardware schedule.
6. Provide stabilizing 3 ½” minimum tubular mid-rail at all doors.
7. Provide internal steel reinforcement for specified hardware configurations.
8. Finish: Exposed stiles, rails, trim or trim caps to be 304 stainless steel.
9. Provide Markar HG305 hinge 32D with left hand adjusta-screw for all doors.

2.05 ALUMINUM FINISHES

A. Refer to Section 084113.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's recommendations and specifications for the installation of the doors and frames. Factory install hardware on the doors.

B. Set units plumb, level and true to line, without warp or rack of doors or frames. Anchor securely in place. Separate aluminum and other metal surfaces with bituminous coatings or other means as approved by architect.

C. Set thresholds in a bed of mastic and backseal.

D. Clean surfaces promptly after installation of doors and frames, exercising care to avoid damage to the protective coatings.

E. Ensure that the doors and frames will be without damage or deterioration.

F. Provide Owner with all adjustment tools and instruction sheets. Arrange an in-service session to Owner at Owner's convenience. Any workmanship that is defective or deficient shall be corrected to the Owner's satisfaction and at no additional cost to the Owner.

END OF SECTION 084115

SECTION 084229.23 - SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior and interior, sliding, power-operated automatic entrances.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For automatic entrances.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Include diagrams for power, signal, and control wiring.
3. Indicate locations of activation and safety devices.
4. Include hardware schedule and indicate hardware types, functions, quantities, and locations.

C. Sample: For each exposed product and for each color and texture specified.

D. Delegated-Design Submittal: For automatic entrances.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AUTOMATIC ENTRANCE ASSEMBLIES

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. Power-Operated Door Standard: BHMA A156.10.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design automatic entrances.

B. Wind Loads: 30 psf.

C. Windborne-Debris Impact Resistance: Automatic entrances shall pass large-missile-impact and small-missile-impact and cyclic-pressure tests of ASTM E 1996 according to the IBC for Wind Zone 4.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. (6.4 L/s x sq. m) of fixed entrance-system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

2.3 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.

B. Sliding Automatic Entrance

1. Biparting-Sliding Units:

2. Basis-of-Design Product: Subject to compliance with requirements, provide Stanley Access Technologies; Dura-Glide 2000 Series or a comparable product by one of the following:

   a. Besam Entrance Solutions; ASSA ABLOY.
   b. DORMA Americas.
   c. Gildor, Inc.
   d. Horton Automatics; a division of Overhead Door Corporation.
   e. Hunter Automatics Inc.

3. Configuration: Biparting-sliding door(s) with transom and pocketed sidelite(s).

   a. Traffic Pattern: Two way.
   b. Emergency Breakaway Capability: Sliding leaves only.
   c. Mounting: Between jambs.

4. Operator Features:

   a. Power opening and closing.
   b. Drive System: Belt.
   c. Adjustable opening and closing speeds.
   d. Adjustable hold-open time between zero and 30 seconds.
   e. Obstruction recycle.
   f. On-off/hold-open switch to control electric power to operator, key operated.

5. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.

   a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

6. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless-steel, ball-bearing-center roller wheels.

a. Configuration: Saddle-type threshold across door opening and surface-mounted guide-track system at sidelites.

7. Controls: Activation and safety devices according to BHMA standards.

a. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone] to activate door operator.
b. Safety Device: Presence sensor mounted on each side of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.

8. Finish: Finish framing, door(s), and header with Class I, clear anodic finish.

2.4 ENTRANCE COMPONENTS

A. Framing Members: Extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 4-1/2 inches (45 by 115 mm).
2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch (1.6-mm) wall thickness.

B. Stile and Rail Doors: 1-3/4-inch- (45-mm-) thick, glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: Snap-on, extruded-aluminum stops and preformed gaskets.
2. Stile Design: Medium stile, 3-1/2-inch (90-mm) nominal width.
3. Bottom Rail Design: 10-inch (254-mm) nominal height.
4. Muntin Bars: Horizontal tubular rail member for each door; match stile design and finish.

C. Sidelite(s) and Transom: 1-3/4-inch- (45-mm-) deep sidelite(s) and transom with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members matching door design.
1. Glazing Stops and Gaskets: Snap-on, extruded-aluminum stops and preformed gaskets.
2. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.

D. Headers: Fabricated from minimum 0.125-inch- (3.2-mm-) thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

1. Mounting: Concealed, with one side of header flush with framing.

E. Signage: As required by cited BHMA standard.

1. Application Process: Door manufacturer's standard process.

2.5 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B 221 (ASTM B 221M).
2. Sheet: ASTM B 209 (ASTM B 209M).

B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

C. Glazing: As specified in Section 088000 "Glazing."

D. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."

E. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107/C 1107M; of consistency suitable for application.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.6 DOOR OPERATORS AND CONTROLS

A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.

1. Door Operator Performance: Door operators shall open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
2. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off.

C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by its plastic housing; adjustable to provide detection-field sizes and functions required by BHMA A156.10.

1. Provide capability for switching between bidirectional and unidirectional detection.

D. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.

E. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

F. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.7 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.

B. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Interrupt powered operation of door operator while in breakaway mode.

C. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch- (25-mm-) long throw bolt; BHMA A156.5, Grade 1.

1. Cylinders: As specified in Section 087100 "Door Hardware."

a. Keying: Integrate into building master key system.

2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
3. Two-Point Locking for Stile and Rail Sliding Doors: Mechanism in stile of active door leaf that automatically extends second lockbolt into overhead carrier assembly.

D. Provide integration with Building's Access Control System.

E. Weather Stripping: Replaceable components.

1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.8 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

1. Provide components with concealed fasteners and anchor and connection devices.
2. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
3. Fabricate exterior components to drain condensation and water passing joints within system to the exterior.
4. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
5. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors.

G. Controls:

1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.

1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
4. Level recesses for recessed thresholds using nonshrink grout.

C. Door Operators: Connect door operators to electrical power distribution system.

D. Access-Control Devices: Connect access-control devices to access-control system.

E. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Glazing: Install glazing as specified in Section 088000 "Glazing."

G. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.

1. Set thresholds, and framing members and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

H. Signage: Apply signage on both sides of each door as required by cited BHMA standard for direction of pedestrian travel.

I. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 FIELD QUALITY CONTROL

A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Automatic entrances will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 ADJUSTING

A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 084229.23

SECTION 084523 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aluminum-framed assemblies incorporating fiberglass-sandwich panel.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel assemblies. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Evaluation Research Reports: For fiberglass-sandwich-panel assemblies from ICC-ES.

C. Field quality-control reports.

D. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Loads:

1. Wind Loads: As Indicated on Drawings.

2. Snow Loads: As Indicated on Drawings.

B. Structural-Test Performance: ASTM E 330.

1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding [0.2] <Insert number> percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

C. Windborne-Debris-Impact-Resistance Performance: Provide panel assemblies that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and the testing information in ASTM E 1996 for Wind Zone 4.

1. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
2. Small-Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.

D. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

E. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): [120 deg F (67 deg C), ambient; 180 deg F (100 deg C)] <Insert temperature range>, material surfaces.

F. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:

1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.80 Btu/sq. ft. x h x deg F (4.54 W/sq. m x K) as determined according to NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas shall have a SHGC of no greater than 0.7 as determined according to NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2.2 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kalwall Corporation; Flat Curb Type Translucent Skylight System or a comparable product by one of the following:

a. Major Industries, Inc.

2.3 FIBERGLASS-SANDWICH PANELS

A. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.

B. Panel Thickness: 2-3/4 inches (70 mm).

C. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).

1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), in alloy and temper recommended in writing by manufacturer.
2. I-Beam Construction: One piece, extruded aluminum.
3. Grid Pattern: Inline rectangle, nominal 12 by 24 inches (305 by 610 mm).

D. Exterior Face Sheet:

1. Thickness: 0.060 inch (1.52 mm).
2. Color: White.
3. Protective Weathering Surface: Manufacturer's standard.

E. Interior Face Sheet:

1. Thickness: 0.045 inch (1.14 mm).
2. Color: White.

F. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.

G. Panel Strength:

1. Maximum Panel Deflection: 3-1/2 inches (89 mm) when a 4-by-12-foot (1.2-by-3.6-m) panel is tested according to ASTM E 72 at 34 lbf/sq. ft. (1.6 kPa), with a maximum 0.090-inch (2.3-mm) set deflection after five minutes.
2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf (1334-N) concentrated load when applied to a 3-inch- (76-mm-) diameter disk according to ASTM E 661.

H. Panel Performance:

1. Self-Ignition Temperature: 650 deg F (343 deg C) or more according to ASTM D 1929.
2. Smoke-Developed Index: 450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
3. Color Change: Not more than 3.0 units Delta E, when measured according to ASTM D 2244, after outdoor weathering compliant with procedures in ASTM D 1435.

    a. Outdoor Weathering Conditions: Sixty months in southern Florida.

4. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf (81 J) by a 3-1/4-inch- (83-mm-) diameter, 5-lb (2.3-kg) freefalling ball according to UL 972 test procedure.

2.4 ALUMINUM FRAMING SYSTEMS

A. Components: One piece, extruded aluminum.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429 (/B 429M).
4. Structural Profiles: ASTM B 308 (/B 308M).

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 (/A 123M) or ASTM A 153 (/A 153M)requirements.

F. Anchor Bolts: ASTM A 307, Grade A, galvanized steel.

G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Exposed Flashing and Closures: Aluminum sheet not less than 0.040 inch (1.02 mm) thick, finished to match framing.

I. Framing Gaskets: Manufacturer's standard.

J. Frame-System Sealants: As recommended in writing by manufacturer.

K. Corrosion-Resistant Coating: Cold-applied asphalt mastic.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written instructions.

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
5. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install components plumb and true in alignment with established lines and elevations.

D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters. Install components to drain water passing through joints and moisture migrating within assembly to exterior.

E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m), but no greater than 1/2 inch (13 mm) over total length.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.

END OF SECTION 084523

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 Refer to "General and Special Conditions", and "Instructions to Bidders", Division 1 of Specifications. Requirements of these Sections and the project drawings shall govern work in this section.

1.2 Work Included:

A. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.

B. Related work:

1. Division 00 00 00 – Procurement and Contracting Requirements
2. Division 01 00 00 – General Requirements
3. Division 06 00 00 – Wood, Plastics, and Composites
4. Division 08 00 00 – Openings
5. Division 10 00 00 – Specialties
6. Division 11 00 00 – Equipment
7. Division 26 00 00 – Electrical
8. Division 27 00 00 – Communications
9. Division 28 00 00 – Electronic Safety and Security

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:

1. Cabinet Hardware.
2. Signs, except as noted.
3. Folding partitions, except cylinders where detailed.
4. Sliding aluminum doors
5. Chain link and wire mesh doors and gates
6. Access doors and panels
7. Overhead and Coiling doors

1.3 Quality Assurance

A. Requirements of Regulatory Agencies:

1. Furnish finish hardware to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
2. Furnish finish hardware to comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.

3. Provide hardware for fire-rated openings in compliance with NFPA 80 and state and local building code requirements. Provide only hardware that has been tested and listed by UL for types and sizes of doors required and complies with requirements of door and door frame labels.

B. Hardware Supplier:

1. Shall be an established firm dealing in contract builders' hardware. He must have adequate inventory, qualified personnel on staff and be located within 100 miles of the project. The distributor must be a factory-authorized dealer for all materials required. The supplier shall be or have in employment an Architectural Hardware Consultant (AHC).

C. Electrified Door Hardware Supplier:

1. Shall be an experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
2. Shall prepare data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this project.
3. Shall have experience in providing consulting services for electrified door hardware installations.

D. Pre-installation Meeting:

1. Before hardware installation, General Contractor/Construction Manager will request a hardware installation meeting be conducted on the installation of hardware; specifically that of locksets, closers, exit devices, overhead stops and coordinators. Manufacturer's representatives of the above products, in conjunction with the hardware supplier for the project, shall conduct the meeting. Meeting to be held at job site and attended by installers of hardware for aluminum, hollow metal and wood doors. Meeting to address proper coordination and installation of hardware, per finish hardware schedule for this specific project, by using installation manuals, hardware schedule, templates, physical product samples and installation videos.
2. When any electrical or pneumatic hardware is specified this meeting shall also include the following trades/installers: Electrical, Security, Alarm systems and Architect.
3. Convene one week or more prior to commencing work of this Section.
4. The Hardware Supplier shall include the cost of this meeting in his proposal.

E. Manufacturer:

1. Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
2. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

1.4 Submittals:

A. Hardware Schedule

1. Submit number of Hardware Schedules as directed in Division 1.

2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
3. Schedule will include the following:
   a. Door Index including opening numbers and the assigned Finish Hardware set.
   b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	SPECIFIED	SCHEDULED
Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

   c. Hardware Locations: Refer to Article 3.1 B.2 Locations.
   d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
   e. Hardware Description: Quantity, category, product number, fasteners, and finish.
   f. Headings that refer to the specified Hardware Set Numbers.
   g. Scheduling Sequence shown in Hardware Sets.
   h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
   i. Electrified Hardware system operation description.
   j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
   k. Typed Copy.
   l. Double-Spacing.
   m. 8-1/2 x 11 inch sheets
   n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:

1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
2. Submit product data with hardware schedule.

C. Samples:

1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

D. Key Schedule:

1. Submit detailed schedule indicating clearly how the Owner's final keying instructions have been followed.
2. Submit as a separate schedule.

E. Electrified Hardware Drawings:

1. Submit elevation drawings showing relationship of all electrical hardware components to door and frame. Indicate number and gage of wires required.
   a. Include wiring drawing showing point to point wire hook up for all components.
   b. Include system operations descriptions for each type of opening; describe each possible condition.

F. Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.

1.5 Product Delivery, Storage, and Handling:

A. Label each item of hardware with the appropriate door number and Hardware Schedule heading number, and deliver to the installer so designated by the contractor.

1.6 Warranties:

A. Refer to Division 1 for warranty requirements.

B. Special Warranty Periods:

1. Closers shall carry manufacturer's 25-year warranty against manufacturing defects and workmanship.
2. Locksets shall carry manufacturer's 3-year warranty against manufacturing defects and workmanship.
3. Continuous gear hinges shall carry manufacturer's lifetime warranty to be free from defects in material and workmanship.
4. Balance of items shall carry a manufacturer's 1-year warranty against manufacturing defects and workmanship.

C. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work.

PART 2 - PRODUCT

2.1 Furnish each category with the products of only one manufacturer unless specified otherwise; this requirement is mandatory whether various manufacturers are listed or not.

2.2 Provide the products of manufacturer designated or if more than one manufacturer is listed, the comparable product of one of the other manufacturers listed. Where only one manufacturer or product is listed, it is understood that this is the owner’s Building Standard and "no substitution" is allowed.

A. Hinges:

1. Furnish hinges of class and size as listed in sets.
2. Numbers used are Ives (IVE).
3. Products by Hager, Stanley & McKinney are also acceptable.

B. Continuous Gear Hinge:

1. 6063-T6 aluminum alloy, anodized finish (cap on entire hinge painted if specified). Manufacture to template, uncut hinges non-handed, pinless assembly, three interlocking extrusions, full height of door and frame, lubricated polyacetal thrust bearing, fasteners 410 stainless steel plated and hardened. All hinge profiles to be manufactured to template bearing locations, with standard duty bearing configurations at 5-1/8" spacing with a minimum of 16 bearings: and heavy duty at 2-9/16" spacing with a minimum of 32 bearings. Anodizing of material shall be done after fabrication of components so that all bearing slots are anodized.
2. Length: 1" less than door opening height. Fastener 12-24 x 1/2" #3 Phillips keen form stainless steel self-tapping at aluminum and hollow metal doors, 12- 1/2" #3 Philips, flathead full thread at wood doors.
3. Furnish fire rated hinges "FR" at labeled openings.
4. Numbers used are Ives.
   a. For Aluminum frames;
      1) Ives 112HD
      2) Equal products by Hager & Select will also be accepted.

C. Flush Bolts:

1. Manual – wood and metal doors:
   a. Ives FB458 Series
   b. Equal product of any B.H.M.A. member.

D. Locksets and Latchsets - Mortise Type:

1. Locksets shall be manufactured from heavy gauge steel, minimum lockcase thickness 1/8", containing components of steel with a zinc dichromate plating for corrosion resistance.
2. Locks are to have a standard 2 ¾" backset with a full ¾" throw two-piece stainless steel mechanical anti-friction latchbolt. Deadbolt shall be a full 1" throw, constructed of stainless steel.
3. Lockcase shall be easily handed without chassis disassembly by removing handing screw on lockcase and installing in opposite location on reverse side. Changing of door hand bevel from standard to reverse hand shall be done by removing the lockcase scalp plate, and pulling and rotating the latchbolt 180 degrees.
4. Lock trim shall be through-bolted to the door to assure correct alignment and proper operation. Lever trim shall have external spring cage mechanism to assist in support of the lever weight. Thumb turns shall have "EZ" thumbturn equal to Schlage L583-363.
5. Function numbers are Schlage.
   a. Schlage L9000
6. Lockset Trim:
   a. Schlage 07B
7. Provide strikes with extended lips where required to protect trim from being marred by latch bolt. Provide strike lips that do not project more than 1/8" beyond door frame trim at single doors and have 7/8" lip to center at pairs of 1-3/4" doors.

E. Locksets and Latchsets – Heavy Duty Cylindrical Type:

1. Function numbers listed are Schlage.
2. Provide 2-3/4 inch backset.
3. Provide strikes with extended lips where required to protect trim from being marred by latch bolt. Provide strike lips that do not project more than 1/8" beyond doorframe trim at single doors and have 7/8" lip to center at pairs of 1-3/4" doors.
4. Locksets and Latchsets:
   a. Schlage ND
5. Lockset Trim:
   a. Schlage Athens

F. Exit Devices

1. All exit devices shall meet ANSI A156.3, 1994, Grade 1 test standards.
2. Devices shall be push through type with stainless steel touch pad design.
3. Center Case: Shall be interchangeable with all functions.
4. Mechanism End Cap: Shall be a stamped or forged metal. Plastic end caps will not be acceptable.
5. Trim: Shall be heavy-duty type.
6. The following manufacturers will be acceptable providing they meet the above criteria for exit devices:
   a. Falcon 24/25 Series
7. Trim:
   a. As specified in sets.
   b. Levers to match lockset design where specified.

G. Push and Pull Hardware:

1. Push Plates: Ives 8200 Series 3.5 x 15 x .050 inches.
2. Pull Plates: Ives 8302-8 3.5 x 15 x .050 inches. 8” center.
3. Manufacturer: Provide push and pull hardware from any member of B.H.M.A.

H. Electric Strike:

1. Electric strikes shall provide remote release of latchbolts. They shall be designed for use with the type locks shown at each opening where required. Strikes will be UL Listed for Burglary-Resistant Electric Door Strike, and where required, shall be UL listed as electric strikes for Fire Doors or Frames. Faceplates shall be stainless steel with finish as specified for each opening. The locking components shall be stainless steel to resist damage and abuse.
2. Solenoids shall be of the continuous duty type for the voltage specified. Plug connectors will be furnished. Strikes shall have an adjustable backbox to compensate for misalignment of door and frame.
3. Numbers used in sets are Von Duprin.
   a. Von Duprin 6000 series

I. Closers

1. Refer to door and frame details and furnish accessories such as drop plates, panel adapters, spacers and supports as required to correctly install door closers. State degree of door swing in the hardware schedule.
2. Acceptable manufacturers and types:
   a. LCN 1450 series as listed in sets.

J. Overhead Holders and Stops:

1. Type, function and fasteners must be same as Glynn-Johnson specified. Size per manufacturer's selector chart. Plastic end caps, hold open mechanisms and shock blocks are not allowed. End caps must be finished same as balance of unit.
2. Manufacture products using base material of Brass/Bronze for US3, US4, & US10B finished products and 300 Stainless Steel for US32 & US32D finished products.
3. Type, function, and fasteners must be the same as Glynn-Johnson specified. Size per manufacturer's selector chart.
   a. Glynn-Johnson

K. Kick Plates:

1. Furnish .050 inches thick, beveled four sides, countersunk fasteners, 10" high x door width less 2" at single doors and less 1" at pairs. Where glass or louvers prevent this height, supply with height equal to height of bottom rail less 2".
2. Any BHMA manufacturing product meeting above is acceptable.

L. Bumpers:

1. Wrought, forged, or cast, approximately 2-1/2 inch diameter, convex or concave rubber center, concealed fasteners.
   a. Ives WS406/WS407
   b. BHMA L02101.

M. Wall Stops:

1. Length to exceed projection of all other hardware. Provide with threaded studs and expansion shields for masonry wall construction.
   a. Ives WS447
   b. BHMA L12011 or L12021

N. Thresholds:

1. 1/2" high - 5" wide. Cope at jambs.
2. Furnish full wall opening width when frames are recessed.
3. Cope in front of mullions if thresholds project beyond door faces.
4. Furnish with non-ferrous Stainless Steel Screws and Lead Anchors.
   a. National Guard as listed in sets
   b. Equal of Zero or Reese

O. Door Sweeps:

1. Surface Sweeps:
   a. National Guard as listed in sets
   b. Equal by Zero or Reese

P. Miscellaneous:

1. Furnish items not categorized in the above descriptions but specified by manufacturer's names in Hardware Sets.

Q. Fasteners:

1. Furnish fasteners of the proper type, size, quantity and finish. Use machine screws and expansion shields for attaching hardware to concrete or masonry, and wall grip inserts at hollow wall construction. Furnish machine screws for attachment to reinforced hollow metal doors and frames and reinforced aluminum doors and frames. Furnish full thread wood screws for attachment to solid wood doors and frames. "TEK" type screws are not acceptable.
2. Sex bolts will not be permitted on reinforced metal doors or wood doors where blocking is specified.

2.3 Finishes:

A. Generally, Dull Chrome, US26D / BHMA 626. Provide finish for each item as indicated in sets.

2.4 Templates and Hardware Location:

A. Furnish hardware made to template. Supply required templates and hardware locations to the door and frame manufacturers.

B. Furnish metal template to frame/door supplier for continuous hinge.

C. Refer to Article 3.1 B.2, Locations, and coordinate with templates.

2.5 Cylinders and Keying:

A. All cylinders for this project will be supplied by one supplier regardless of door type and location.

B. The Finish Hardware supplier will meet with Architect and/or Owner to finalize keying requirements and obtain keying instructions in writing.
1. Supplier shall include the cost of this service in his proposal.

C. Provide a cylinder for all hardware components capable of being locked.

D. Provide cylinders master and grand master keyed to designated system according to Owner's instructions. Provide change keys, master keys and grand master keys as required by Owner.

E. Provide cylinders with construction cores or keying for use during the construction period. When so directed, and in the presence of the Owner's security department or representative, convert construction cores or keying to the final system.
1. Supplier shall include the cost of this service in his proposal.

PART 3 - EXECUTION

3.1 Installation

A. General:

1. Install hardware according to manufacturers installations and template dimensions. Attach all items of finish hardware to doors, frames, walls, etc. with fasteners furnished and required by the manufacture of the item.
2. Provide blocking/reinforcement for all wall mounted Hardware.
3. Reinforced hollow metal doors and frames and reinforced aluminum door and frames will be drilled and tapped for machine screws.
4. Solid wood doors and frames: full thread wood screws. Drill pilot holes before inserting screws.
5. Continuous gear hinges attached to hollow metal doors and frames and aluminum doors and frames: 12-24 x 1/2" #3 Phillips Keenform self-tapping. Use #13 or 3/16 drill for pilot.
6. Continuous Gear Hinges require continuous mortar guards of foam or cardboard 1/2" thick x frame height, applied with construction adhesive.
7. Install weather-strip gasket prior to parallel arm closer bracket, rim exit device or any stop mounted hardware. Gasket to provide a continuous seal around perimeter of door opening. Allow for gasket when installing finish hardware. Door closers will require special templating. Exit devices will require adjustment in backset.

B. Locations:

1. Dimensions are from finish floor to center line of items.
2. Include this list in Hardware Schedule.

CATEGORY	DIMENSION
Hinges	Door Manufacturer's Standard
Flush Bolt Levers	72" and 12"
Levers	Door Manufacturer's Standard
Exit Device Touchbar	Per Template / as indicated in Door Types
Offset Pulls	Suitable for Exit Devices
Push Plates	52"
Pull Plates	42"
Wall Stops/Holders	At Head
Lock Protectors	Pull side of door

C. Field Quality Inspection:

1. Inspect material furnished, its installation and adjustment, and instruct the Owner's personnel in adjustment, care and maintenance of hardware.
2. Locksets and exit devices shall be inspected after installation and after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
3. Closers shall be inspected and adjusted after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
4. A written report stating compliance, and also locations and kinds of noncompliance shall be forwarded to the Architect with copies to the Contractor, hardware distributor, hardware installer and building owner.

D. Technical and Warranty Information:

1. At the completion of the project, the technical and warranty information coalesced and kept on file by the General Contractor/Construction Manager shall be given to the Owner or Owner's Agent. In addition to both the technical and warranty information, all factory order acknowledgement numbers supplied to the General Contractor/Construction Manager during the construction period shall be given to the Owner or Owner's Agent. The warranty information and factory order acknowledgement numbers shall serve to both expedite and properly execute any warranty work that may be required on the various hardware items supplied on the project.
2. Submit to General Contractor/Construction Manager, two copies each of parts and service manuals and two each of any special installation or adjustment tools. Include for locksets, exit devices, door closers and any electrical products.

3.2 Hardware Sets:

HARDWARE SET NO. 01

EACH TO HAVE:

1	EA	MORTISE CYLINDER	20-001 114	626	SCH
			* BALANCE OF HDWE BY DOOR MFR *		

HARDWARE SET NO. 02

EACH TO HAVE:

* ALL HDWE BY DOOR MFR *

HARDWARE SET NO. 03

EACH TO HAVE:

4	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 3.5" X 15"	630	IVE
1	EA	PULL PLATE	8302 8" 3.5" X 15"	630	IVE
1	EA	SURFACE CLOSER	1450 HCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

HARDWARE SET NO. 04

EACH TO HAVE:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD ATH	626	SCH
1	EA	OH STOP	410S	630	GLY

HARDWARE SET NO. 05

EACH TO HAVE:

6	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	STOREROOM LOCK	ND80PD ATH	626	SCH
2	EA	OH STOP	410S	630	GLY

HARDWARE SET NO. 06

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	24-R-NL-OP	626	FAL
1	EA	RIM CYLINDER	20-022	626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE	630	VON
1	EA	90 DEG OFFSET PULL	8190HD 12" O	630	IVE
1	EA	SURFACE CLOSER	1450 SCUSH	689	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600A	CL	NGP
1	EA	THRESHOLD	425	AL	NGP
1	EA	POWER SUPPLY	PS902	LGR	VON
1	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)		

PRESENTING AN AUTHORIZED CREDENTIAL WILL ENERGIZE THE ELECTRIC STRIKE AND ALLOW ACCESS. FREE EGRESS IS ALWAYS ALLOWED.
COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

HARDWARE SET NO. 07

EACH TO HAVE:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S ATH	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE SET NO. 08

EACH TO HAVE:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD ATH	626	SCH
1	EA	WALL STOP	WS447	626	IVE

HARDWARE SET NO. 09

EACH TO HAVE:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD ATH	626	SCH
1	EA	SURFACE CLOSER	1450 RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE

HARDWARE SET NO. 10

EACH TO HAVE:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD ATH	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE SET NO. 11

EACH TO HAVE:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S ATH	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	2525B	BRN	NGP

HARDWARE SET NO. 12

EACH TO HAVE:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PRIV W/DB COIN TURN	L9444 07B L583-363 L283-722	626	SCH
1	EA	SURFACE CLOSER	1450 RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS447	626	IVE
1	SET	SEALS	2525B	BRN	NGP

HARDWARE SET NO. 13

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	STOREROOM LOCK	L9080P LLL 03B	626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE	630	VON
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	CONCEALED PULL	(BY DOOR MFR)		
1	EA	SURFACE CLOSER	1450 SHCUSH	689	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600A	CL	NGP
1	EA	THRESHOLD	425	AL	NGP
1	EA	POWER SUPPLY	PS902	LGR	VON
1	EA	ACCESS CONTROL	(BY SECURITY CONTRACTOR)		

PRESENTING AN AUTHORIZED CREDENTIAL WILL ENERGIZE THE ELECTRIC STRIKE AND ALLOW ACCESS. FREE EGRESS IS ALWAYS ALLOWED.
COORDINATE SYSTEM OPERATION AND COMPONENT LOCATIONS WITH THE OWNER, THE ARCHITECT AND ALL RELATED TRADES.

HARDWARE SET NO. 14

EACH TO HAVE:

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	DBL CYL STORE LOCK	ND66PD ATH	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glass for doors, interior borrowed lites, storefront framing.
2. Glazing sealants and accessories.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Industries, Inc. or comparable product by one of the following:

1. AGC Glass Company North America, Inc.
2. Guardian Industries Corp.; SunGuard.
3. Oldcastle BuildingEnvelope™.
4. Pilkington North America.
5. Schott North America, Inc.
6. Trulite Glass & Aluminum Solutions, LLC.
7. Viracon, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: <Insert design snow load> [As indicated on Drawings].
3. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with basic-protection testing requirements in ASTM E 1996 for Wind Zone 4 when tested according to ASTM E 1886. Test specimens

shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.

1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
2. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seals.
2. Spacer: Aluminum with mill or clear anodic finish.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

F. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.4 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.5 MONOLITHIC GLASS SCHEDULE

A. Glass Type (MG-10): Clear annealed or heat-strengthened float glass.

1. Minimum Thickness: 6 mm.

B. Glass Type (MG-11): Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety rated glazing.

C. Glass Type (MG-12): Clear fully tempered float glass.

1. Minimum Thickness: 9 mm.
2. Safety rated glazing.
3. Edge Treatment: CNC polish with external radius (at exposed edges).

3.6 INSULATING GLASS SCHEDULE

A. Glass Type (IG-10): Low-E-coated, tinted insulating glass.

1. Basis-of-Design Product: PPG Industries, Solarban 60, Low-E, Insulated Glass “Azuria”.
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Tinted annealed or heat-strengthened float glass.
5. Tint Color: Blue-green.
6. Interspace Content: Air.
7. Indoor Lite: Clear annealed or heat-strengthened float glass.
8. Low-E Coating: Sputtered on third surface.
9. Winter Nighttime U-Factor: .29 maximum.
10. Summer Daytime U-Factor: .27 maximum.
11. Visible Light Transmittance: 54 percent minimum.
12. Solar Heat Gain Coefficient: .31 maximum.

B. Glass Type (IG-11): Low-E-coated, tinted, fully tempered, insulating glass.

1. Same as IG-10 above, but fully tempered.
2. Safety rated glazing.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Sample Panels: Build sample wall to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample of typical exterior wall, minimum dimension of 60 inches (1500 mm) long by 48 inches (1200 mm)] high by full thickness. Show all wall components including by not limited to: Metal studs, sheathing, vapor barrier, insulation, flashing, masonry, masonry accessories, etc. Include window jamb and sill as well. Coordinate with other sections.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:
    a. Minimum Base-Metal Thickness: 0.0269 inch (0.683 mm) or as required by performance requirements for horizontal deflection.
    b. Depth: As indicated on Drawings

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Steel Network Inc. (The); VertiClip SLD Series.
        2) Superior Metal Trim; Superior Flex Track System (SFT).

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.0269 inch (0.683 mm).

E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 1-1/2 inches (38 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.0296 inch (0.752 mm).
2. Depth: As indicated on Drawings.

G. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.

H. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.0179 inch (0.455 mm), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: As indicated on Drawings.

D. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
2. Steel Studs and Runners: ASTM C 645.

    a. Minimum Base-Metal Thickness: 0.0269 inch (0.683 mm).
    b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.

    a. Minimum Base-Metal Thickness: 0.0296 inch (0.752 mm).

4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.

    a. Configuration: Asymmetrical or hat shaped.

E. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    b. Chicago Metallic Corporation; 640-C Drywall Furring System.
    c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.

2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c.
2. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.3 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each texture finish indicated on same backing indicated for Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum Co.
b. BPB America Inc.
c. Georgia-Pacific Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.

f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
1. Thickness: 1/4 inch (6.4 mm).
2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

E. Abuse-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
1. Core: 5/8 inch (15.9 mm), Type X.
2. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
3. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
5. Long Edges: Tapered.
6. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

F. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Basis of Design: Subject to compliance with requirements, provide "DensGlass Sheathing” by Georgia-Pacific Gypsum or equal.
2. Core: 5/8 inch (15.9 mm), Type X.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Basis of Design: Subject to compliance with requirements, provide "DensShield Tile Backer" by Georgia-Pacific Gypsum or equal.
2. Core: 5/8 inch (15.9 mm), Type X.

3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:
   1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: As specified in Section 072100 "Thermal Insulation."

E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C 840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Prefill open joints and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: [Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

4. Level 5: Where indicated on Drawings.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

H. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

I. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.2 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Porcelain tile.
2. Glazed wall tile.
3. Solid polymer thresholds.
4. Waterproof membrane for thinset applications.
5. Crack isolation membrane.
6. Metal edge strips.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Solid polymer thresholds.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type (but not less than 10 full size units of each type), composition, color, pattern, and size indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer employs Ceramic Tile Education Foundation Certified Installers or] installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Porcelain Tile Type (PT-1): Unglazed porcelain tile.

1. Basis of Design: Subject to compliance with requirements, provide Caesar Contract Solutions “Maison” porcelain floor tile.
2. Face Size: 11-13/16” x 23-5/8”.
3. Thickness: 3/8 inches.
4. Face: Plain with square edges.
5. Dynamic Coefficient of Friction: Not less than 0.60.
6. Pattern: Refer to floor finish plans.
7. Tile Colors: Refer to ‘Material Finish / Color Schedule Section 000200’.
8. Grout Color: Refer to ‘Material Finish / Color Schedule Section 000200’ for color selections.

B. Glazed Wall Tile Type (CT-1):

1. Basis of Design: Subject to compliance with requirements, provide American Olean “Bright and Matte Profiles” glazed wall tile.
2. Module Size: 3 by 6 inches.
3. Thickness: 5/16 inch.
4. Face: Plain with modified square edges.
5. Finish: Bright, opaque glaze.
6. Pattern: Refer to drawings and material finish / color schedule for descriptions of patterns.
7. Tile Colors / Patterns: Refer to ‘Material Finish / Color Schedule Section 000200’.
8. Grout Color: Refer to ‘Material Finish / Color Schedule Section 000200’ for color selections.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Wall Base: Coved, module size 3 x 6 inches.

    b. Bullnose: Top bullnose, module size 3 x 6 inches.

C. Glass Accent Wall Tile Type (CT-2):

1. Basis of Design: Subject to compliance with requirements, provide Stone Tiles International “Bliss Stock Glass / Stone” 5/8” x 5/8” mosaic wall tile.

2. Module Size: 5/8 by 5/8 inches (12” x 12” sheets cut into strips as indicated on drawings)
3. Thickness: 5/16 inch.
4. Face: Plain with modified square edges.
5. Finish: Honed / glass.
6. Pattern: Refer to drawings and material finish / color schedule for descriptions of patterns.
7. Tile Colors / Patterns: Refer to ‘Material Finish / Color Schedule Section 000200’.
8. Grout Color: Refer to ‘Material Finish / Color Schedule Section 000200’ for color selections.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes. Refer to drawings for required profiles.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/4 inch or less above adjacent floor surface.

B. Solid Polymer Thresholds: Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6.

1. Subject to compliance with requirements, provide “Corian Solid Surface” threshold.

2. Thickness: 1/2".
3. Color: Refer to Material Color / Finish Schedule, specification section 000200.
4. Profile: As indicated on drawings.

2.4 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.5 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ARDEX GmbH.
   b. Boiardi Products Corporation; a QEP company.
   c. Bonsal American, an Oldcastle company.
   d. Bostik, Inc.
   e. Laticrete International, Inc.
   f. MAPEI Corporation.
   g. TEC; H.B. Fuller Construction Products Inc.

2. For wall applications, provide nonsagging mortar.

2.6 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ARDEX GmbH.
b. Boiardi Products Corporation; a QEP company.
c. Bonsal American, an Oldcastle company.
d. Bostik, Inc.
e. Custom Building Products.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. TEC; H.B. Fuller Construction Products Inc.

2. Polymer Type: Liquid-latex form for addition to prepackaged dry-grout mix.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Blanke Corporation.
b. Ceramic Tool Company, Inc.
c. Schluter Systems L.P.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch.
2. Glazed Wall Tile: 1/16 inch.
3. Porcelain Tile: 1/8 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Thresholds: Install thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
1. Fill joints between such thresholds and adjoining tile set on crack isolation membrane with elastomeric sealant.

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

L. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Porcelain Tile Installation (Typical floor areas): TCNA F113; thinset mortar.

a. Porcelain Tile Type: Typical floor tile.
b. Thinset Mortar: Latex-portland cement mortar.
c. Grout: High-performance sanded grout.

B. Interior Wall Installations, Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.

a. Ceramic Tile Type: Typical wall tile.
b. Thinset Mortar: Latex-portland cement mortar.
c. Grout: High-performance unsanded grout.

END OF SECTION 093013

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes acoustical tiles and concealed suspension systems for ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each exposed finish.

C. Product test reports.

D. Research/evaluation reports.

E. Maintenance data.

1.3 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory.

B. Fire-Test-Response Characteristics:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Acoustical tiles complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.

a. Smoke-Developed Index: 450 or less.

C. Preinstallation Conference: Conduct conference at Project site.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.

2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL TILE CEILINGS, GENERAL

A. Acoustical Tile Standard: Comply with ASTM E 1264.

B. Metal Suspension System Standard: Comply with ASTM C 635.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm) diameter wire.

E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.2 ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING (ACT-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG “Mars High NRC Clima Plus” or comparable product by Armstrong or Certainteed.

B. Color: White

C. Modular Size: 2’ x 2’ x 1”
1. USG - Mars High NRC Clima Plus #88138

D. Edge: Tegular edge.

E. NRC Rating: .90.

2.3 ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING (ACT-2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG “Olympia Micro Illusion” or comparable product by Armstrong or Certainteed.

B. Color: White

C. Modular Size: 2’ x 4’ x ¾”

1. USG – Micro Illusion #4742

D. Edge: Tegular edge.

2.4 ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING (ACT-3)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG “Olympia Micro” or comparable product by Armstrong or Certainteed.

B. Color: White

C. Modular Size: 2’ x 2’ x 5/8”
1. USG – Olympia Micro #4221

D. Edge: Tegular edge.

2.5 METAL ACOUSTICAL TILE CEILING (ACT-4)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG: “Celebration Torsion Spring System” or a comparable product by Armstrong or Certainteed.

B. Color: As selected in Material Finish / Color Schedule, section 000200.

C. Modular Size: 2’ x 4’.

D. System shall be complete with suspension grid, panels and torsion springs.

E. Provide USG suction grips and USG panel removal hand tool for panel removals.

2.6 METAL ACOUSTICAL TILE CEILING (ACT-5)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG: “Panz” or a comparable product by Armstrong or Certainteed.

B. Color: As selected in Material Finish / Color Schedule, section 000200.

C. Modular Size: 2’ x 4’.

D. Panel Type: Perforated with Acousitibond Backer.

2.7 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING (ACT-1, ACT-2, ACT-3)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG “Donn DX” or a comparable product by one of the following:

1. Armstrong
2. Chicago Metallic Corp.

B. Color: White.

2.8 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING (ACT-5)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG “Fineline Edge with 9/16” Fineline DXF Suspension” or a comparable product by one of the following:

1. Armstrong
2. Chicago Metallic Corp.

B. Color: Color to match ACT-5. Refer to Material Finish / Color Schedule, section 000200.

2.9 VERTICAL METAL FASCIA TRIM (ACT-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG “Compasso Standard” or a comparable product by one of the following:

1. Armstrong
2. Chicago Metallic Corp.

B. Size: 4” high x 9/16” wide.

C. Color: White.

2.10 VERTICAL METAL FASCIA TRIM (ACT-5)

A. Basis-of-Design Product: Subject to compliance with requirements, provide USG “Compasso Elite” or a comparable product by one of the following:

1. Armstrong
2. Chicago Metallic Corp.

B. Size: 10” high x 3/4” wide.

C. Color: Color to match ACT-5. Refer to Material Finish / Color Schedule, section 000200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
2. Do not attach hangers to steel deck tabs.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely. Provide

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE (RB-#)

A. Resilient Base:

1. Manufacturers: Subject to compliance with requirements, provide Roppe Corporation “Pinnacle Rubber Wall Base” or equal product by the following:

a. Allstate Rubber Corp.; Stoler Industries.

b. Armstrong World Industries, Inc.
c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
d. Endura Rubber Flooring; Division of Burke Industries, Inc.
e. Estrie Products International; American Biltrite (Canada) Ltd.
f. Flexco, Inc.
g. Johnsonite
h. Mondo Rubber International, Inc.
i. Musson, R. C. Rubber Co.
j. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
k. PRF USA, Inc.
l. VPI, LLC; Floor Products Division.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Cove (base with toe).

A. Minimum Thickness: 0.125 inch (3.2 mm).

B. Height: As noted on drawings.

C. Lengths: Coils in manufacturer's standard length.

D. Outside Corners: Preformed.

E. Inside Corners: Preformed.

F. Finish: Low luster.

G. Colors and Patterns: Refer to ‘Material Finish / Color Schedule Section 000200’ for color selections.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

1. Manufacturers: Subject to compliance with requirements, provide Roppe Corporation Resilient Molding Accessories or equal products by the following:

a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
b. Flexco, Inc.
c. Johnsonite
d. R.C.A. Rubber Company (The).
e. VPI, LLC; Floor Products Division.

B. Nosing for resilient floor covering, Reducer strip for resilient floor covering and Transition strips.

C. Material: Rubber.

D. Profile and Dimensions: As indicated on drawings.

E. Colors and Patterns: Refer to 'Material Finish / Color Schedule Section 000200' for color selections.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply two coat(s).

C. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Type, color, and location of insets and borders.
8. Type, color, and location of edge, transition, and other accessory strips.
9. Transition details to other flooring materials.

C. Samples: For each exposed product and for each color and texture required.

1.4 IINFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the manufacturer.

1.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ENTRANCE MAT CARPET TILE (CPT-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract Group, “All Access” or approved equal.

B. Color: As listed in Material Finish / Color Schedule.

C. Pattern: Shaw – “Path Tile 5T034”.

D. Fiber Type: Shaw “eco solution q” nylon.

E. Dye Method: 100% solution dyed.

F. Pile Characteristic: Multi-level pattern loop.

G. Density: 8,765 oz./cu. yd.

H. Pile Thickness: 0.115 inches for finished carpet tile.

I. Stitches: 9.0 stiches per inch.

J. Gage: 1/12.

K. Total Weight: 28.0 oz./sq. yd. for finished carpet tile.

L. Primary Backing: Manufacturer's standard synthetic materials.

M. Secondary Backing: Shaw “ecoworx tile”.

N. Size: 24 by 24 inches (610 by 610 mm).

O. Applied Soil-Resistance Treatment: Manufacturer's standard material.

2.2 CARPET TILE (CPT-2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract Group, “Collective Time” or approved equal.

B. Color: As listed in Material Finish / Color Schedule.

C. Pattern: Shaw – “Activity #5T089”.

D. Fiber Type: Shaw “solution q extreme” nylon.

E. Dye Method: 100% solution dyed.

F. Pile Characteristic: Multi-level pattern loop.

G. Density: 7,266 oz./cu. yd.

H. Pile Thickness: 0.109 inches for finished carpet tile.

I. Stitches: 11.0 stiches per inch.

J. Gage: 1/12.

K. Total Weight: 22.0 oz./sq. yd. for finished carpet tile.

L. Primary Backing: Manufacturer's standard synthetic materials.

M. Secondary Backing: Shaw “ecoworx tile”.

N. Size: 24 by 24 inches (610 by 610 mm).

O. Applied Soil-Resistance Treatment: Manufacturer's standard material.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. General: Comply with CRI's "CRI Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer. Review with Architect for approval.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Install carpet tile recessed plate attached to all flush mounted floor electrical / communications boxes.

J. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl (Mural) wall covering.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Strike-offs for each type of wall covering and for each color, pattern, texture, and finish specified, full scale, 12-inches by 36-inches.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

2. Fire-Growth Contribution: No flashover and heat and smoke release according to NFPA 265 and NFPA 286.

2.2 VINYL WALL COVERING (MURAL WALL COVERING)

A. Basis of Design: MDC DreamScape Smooth

B. Description: Provide mildew-resistant products in rolls from same production run and complying with the following:
   1. FS CCC-W-408D, CFFA-W-101-D for Type II, Medium-Duty products.
   2. ASTM F 793 for wall coverings.
      a. Category: IIV, Type I, Commercial Serviceability.

C. Total Weight: 20 oz per lineal yard excluding coatings.

D. Size: As indicated on drawings and to be field verified after rough construction.

E. Backing: Poly-Cotton Osnaburg fabric.
   1. Fiber Content: Polycotton.

F. Repeat: None, full image.

G. Digital Images: Custom digital images and graphics to be supplied by Architect.

H. Texture: To be selected by Architect from Manufacturer's full range (Smooth Matte, Suede or Artist Canvas)

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, non-staining adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation and provide level (4) finish on substrate.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

   1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
   3. Metals: If not factory primed, clean and apply primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

4. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
5. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.2 WALL-COVERING INSTALLATION

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in order to create digital image as designed.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 3 inches (75 mm) 6 inches (150 mm) from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams (double-cut) without overlaps or gaps between strips.

G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

H. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

I. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Galvanized metal.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each finish and for each color and texture required.

C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 2 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As indicated in Material Finish / Color Schedule.

2.2 METAL PRIMERS

A. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

2.3 EXTERIOR LATEX PAINTS

A. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

1. VOC Content: E Range of E1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:

1. Latex System: MPI EXT 5.3A.

a. Prime Coat: Cementitious galvanized-metal primer.
b. Intermediate Coat: Exterior latex matching topcoat.
c. Topcoat: Exterior latex (semigloss).

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Steel.
   2. Galvanized metal.
   3. Gypsum board.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each finish and for each color and texture required.

C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 QUALITY ASSURANCE

A. MPI Standards:

   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
   3. Finishes are to be as follows:
      a. All soffits and gypsum board ceilings are to receive a ‘G1” flat finish.
      b. All gypsum board walls are to receive a ‘G3’ egg shell finish.
      c. All hollow metal door frames are to receive a ‘G5’ semi-gloss finish.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

      a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
      b. Other Items: Architect will designate items or areas required.

   2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
   3. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 2 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Flat Topcoat Paints: VOC content of not more than 50 g/L.
5. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
6. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
7. Floor Coatings: VOC not more than 100 g/L.
8. Shellacs, Clear: VOC not more than 730 g/L.
9. Shellacs, Pigmented: VOC not more than 550 g/L.
10. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
11. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
12. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

2. Restricted Components: Paints and coatings shall not contain any of the following:

a. Acrolein.
b. Acrylonitrile.
c. Antimony.
d. Benzene.
e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

D. Colors: As indicated in Material Finish / Color Schedule.

2.2 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

1. VOC Content: E Range of E1.

2.3 METAL PRIMERS

A. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E1.

2.4 LATEX PAINTS

A. Interior Latex (Flat): MPI #53 (Gloss Level 1).

1. VOC Content: E Range of E1.

B. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

1. VOC Content: E Range of E1.

C. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

1. VOC Content: E Range of E1.

2.6 QUICK-DRYING ENAMELS

A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).

1. VOC Content: E Range of E1.

2.6 ALKYD PAINTS

A. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:
a. Telephone backer boards.
b. Electrical equipment that is indicated to have a factory-primed finish for field painting.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Quick-Drying Enamel System: MPI INT 5.1A. (Use on Hollow Metal Frames, Steel Lintels)

a. Prime Coat: Quick-drying alkyd metal primer.
b. Intermediate Coat: Quick-drying enamel matching topcoat.
c. Topcoat: Quick-drying enamel (semigloss).

2. Latex System: MPI INT 5.1.Q. (Use on Exposed Steel Roof Framing and Roof Deck)

a. Prime Coat: Quick-drying alkyd metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (flat).

B. Gypsum Board Substrates (Ceilings and Soffits):

1. Latex System: MPI INT 9.2A.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (flat).

C. Gypsum Board Substrates (Walls):

1. Latex System: MPI INT 9.2A.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (eggshell).

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Visual display board assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints.

C. Samples: For each type of visual display unit indicated.

D. Product Schedule: For visual display units.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

2.2 VISUAL DISPLAY BOARD ASSEMBLY

A. Visual Display Board Assembly: Factory fabricated.

1. Assembly: Markerboard and tackboard.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.

B. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

C. Tackboard Panel: Vinyl-fabric-faced tackboard panel on core indicated.

1. Fabric Wrapped Edge: Wrap edge of tackboard panel with fabric facing.
2. Color and Pattern: As selected by Architect from full range of industry colors.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape.
1. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

F. Combination Assemblies: Provide manufacturer's standard exposed trim between abutting sections of visual display panels.

2.3 MARKERBOARD PANELS (MBD)

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Face Sheet Thickness: 0.021 inch (0.53 mm) uncoated base metal thickness.
1. Particleboard Core: 1/2 inch (13 mm) thick; with 0.015-inch- (0.38-mm-) thick, aluminum sheet backing.

2. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

3. Manufacturers:

   a. AARCO Products, Inc.
   b. ADP/Lemco, Inc.
   c. Best-Rite Manufacturing.
   d. Claridge Products & Equipment, Inc.
   e. Platinum Visual Systems; a division of ABC School Equipment, Inc.

2.4 MARKERBOARD ACCESSORIES

A. Marker tray: Manufacturer's standard, extruded aluminum, satin anodized finish, magnetic marker tray. Size: 24" long. Provide one tray for each marker board.

2.5 TACKBOARD PANELS (TBD)

A. Vinyl-Fabric-Faced Tack Assembly: 1/8-inch- (3-mm-) thick, vinyl-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.

1. Manufacturers:

   a. AARCO Products, Inc.
   b. ADP/Lemco, Inc.
   c. Best-Rite Manufacturing.
   d. Claridge Products & Equipment, Inc.
   e. Platinum Visual Systems; a division of ABC School Equipment, Inc.

2.6 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.

C. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with surface-burning characteristics indicated.

D. Hardboard: ANSI A135.4, tempered.

E. Particleboard: ANSI A208.1, Grade M-1.

F. Medium-Density Fiberboard: ANSI A208.2, Grade 130.

G. Fiberboard: ASTM C 208 cellulosic fiber insulating board.

H. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

I. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.

END OF SECTION 101100

SECTION 101200 - DISPLAY CASES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bulletin board cases.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For bulletin boards.

1. Include plans, elevations, sections, and attachment details.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For tackboard panels, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

2.2 BULLETIN BOARD

A. Basis of Design: Subject to compliance with requirements, provide Claridge Products “Contemporary Bulletin Board Cabinet” or approved by the following:
1. A-1 Visual Systems.

2. AARCO Products, Inc.
3. ADP Lemco.
4. Best-Rite; MooreCo, Inc.
5. C.R. Laurence Co., Inc.
6. Marsh Industries, Inc.
7. Nelson-Harkins Industries.
8. Platinum Visual Systems
9. Or approved equal.

B. General: Factory-fabricated unit consisting of manufacturer's standard wall-mounted cabinet with tackboard panel on back inside surface and operable glazed doors at front.

1. Frame and Cabinet Profile: Square frame section with square cabinet corners.
2. Mounting: Recessed.
   a. Provide recessed mounting trim without shape edges.
3. Size: As indicated on Drawings.
   a. Type A – Claridge # 2039; 3'-0" W x 3'-6" H.
   b. Type B – Claridge #2044; 6'-0" W x 4'-0" H.

C. Aluminum-Framed Cabinet: Extruded aluminum; with clear anodic finish.

D. Glazed Hinged Doors: Tempered glass; set in frame matching cabinet material and finish. Equip each door with full-height continuous hinge and cylinder lock with two keys.

1. Number of Doors: One at 3'-0" wide cabinet; Two at 6'-0" wide cabinet.

E. Back Panel: Manufacturer's standard vinyl-fabric-faced tackboard panel.

1. Color: As selected by Architect from full range of industry colors.

2.3 MATERIALS

A. Hardboard: ANSI A135.4, tempered.

B. Fiberboard: ASTM C 208.

C. Particleboard: ANSI A208.1, Grade M-1.

D. Hardwood Plywood: HPVA HP-1.

E. Vinyl Fabric: FS CCC-W-408D, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with flame-spread index of 25 or less when tested according to ASTM E 84.

F. Extruded-Aluminum Bars and Shapes: ASTM B 221 (ASTM B 221M), Alloy 6063.

G. Aluminum Tubing: ASTM B 429/B 429M, Alloy 6063.

H. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

2.4 FABRICATION

A. Fabricate bulletin boards to requirements indicated for dimensions, design, and thickness and finish of materials.

B. Use metals and shapes of thickness and reinforcing required to produce flat surfaces, and to impart strength for size, design, and application indicated.

C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

D. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Bulletin Boards: Attach units to wall surfaces with concealed clips, hangers, or grounds.

C. Recessed Display Cases: Attach units to wall framing with fasteners at not more than 16 inches (400 mm) o.c. Attach aluminum trim over edges of recessed display cases and conceal grounds and clips. Attach trim with fasteners at not more than 24 inches (600 mm) o.c.

END OF SECTION 101200

SECTION 101416 - PLAQUES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plaques.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size scale.

C. Samples: For each exposed product and for each color and texture specified.

D. Plaque Schedule: Use same designations specified or indicated on Drawings or in a plaque or sign schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 PLAQUES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Corporation; Braille-Tac Division.
2. A. R. K. Ramos.
3. Gemini Incorporated.
4. Matthews International Corporation; Bronze Division.
5. Metal Arts; Div. of L&H Mfg. Co.
6. Mills Manufacturing Company.
7. Nelson-Harkins Industries.
8. Southwell Company (The).

D. Cast Plaque: Plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Plaque Material: Cast aluminum.
2. Plaque Thickness: 1/2”.
3. Background Texture: Manufacturer’s standard sand texture.
4. Background Color: As selected from Manufacturer’s full range of standard colors
5. Integrally Cast Border Style: Single line bevel.
6. Mounting: Concealed studs, non-corroding for substrates encountered.
7. Provide raised graphic images similar to those indicated on the drawings and as provided by Gemini Inc., or approved equal to design shown on drawings.
8. Raised Graphic / Text Finish: Brushed.
9. Clear Coat Finish: Semi-Gloss.

2.3 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors.

2. Plaque Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque, unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
2. Conceal connections where they are inconspicuous.
3. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
4. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

C. Remove temporary protective coverings and strippable films as plaques are installed.

END OF SECTION 101416

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast dimensional characters.
2. Cutout dimensional characters.
3. Illuminated, fabricated channel dimensional characters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples: For each dimensional character type and for each color and texture specified.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signage, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F**,** ambient; 180 deg F, material surfaces.

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 DIMENSIONAL CHARACTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Gemini Incorporated; Cast Aluminum Letters or a comparable product by one of the following:

a. ACE Sign Systems, Inc.
b. Advance Corporation; Braille-Tac Division.
c. ASI-Modulex, Inc.
d. Grimco, Inc.
e. Innerface Sign Systems, Inc.
f. Metal Arts; Div. of L&H Mfg. Co.
g. Mohawk Sign Systems.
h. Nelson-Harkins Industries.
i. Signature Signs, Incorporated.
j. Signs Fab, Inc.
k. Southwell Company (The).
l. Supersine Company (The).

2. Character Material: Cast aluminum.
3. Character Height: As indicated on drawings.
4. Character Thickness: Varies with respect to height.
   a. 4" = 5/8" thick.
   b. 6" = 3/4" thick.
   c. 8" = 3/4" thick.
   d. 12" = 1" thick.
   e. 18" = 1 1/2" thick.

5. Finish: Baked Enamel to match Architect's sample.
6. Color: Refer to 'Material Finish / Color Schedule Section 000200' for color selections.
7. Font: As selected by Architect from Manufacturer's full line.
8. Mounting: Flush mounting with concealed studs mounts for each individual character.
9. Style: Flat face.

B. Cutout (Flat-Cut) Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Gemini Incorporated; Flat Cut Metal Logo or a comparable product by one of the following:

    a. ACE Sign Systems, Inc.
    b. Advance Corporation; Braille-Tac Division.
    c. ASI-Modulex, Inc.
    d. Grimco, Inc.
    e. Innerface Sign Systems, Inc.
    f. Metal Arts; Div. of L&H Mfg. Co.
    g. Mohawk Sign Systems.
    h. Nelson-Harkins Industries.
    i. Signature Signs, Incorporated.
    j. Signs Fab, Inc.
    k. Southwell Company (The).
    l. Supersine Company (The).

2. Character Material: Plate aluminum.
3. Character Height: As indicated on drawings.
4. Thickness: Manufacturer's standard for size of character [Minimum 0.25 inch (6.35 mm)].
5. Finish: Baked Enamel to match Architect’s sample.
6. Color: Refer to ‘Material Finish / Color Schedule Section 000200’ for color selections.
7. Mounting: Projected spacer mounting for 2-inch distance from wall.

C. Fabricated Channel Characters (Halo-Illuminated Channel Letters): Formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability and for securing fasteners; and as follows.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Gemini Incorporated; Fabricated Metal Halo-Illuminated or a comparable product by one of the following:

    a. ACE Sign Systems, Inc.
    b. Advance Corporation; Braille-Tac Division.
    c. ASI-Modulex, Inc.
    d. Grimco, Inc.
    e. Innerface Sign Systems, Inc.
    f. Metal Arts; Div. of L&H Mfg. Co.
    g. Mohawk Sign Systems.
    h. Nelson-Harkins Industries.
    i. Signature Signs, Incorporated.
    j. Signs Fab, Inc.
    k. Southwell Company (The).
    l. Supersine Company (The).

2. Character Material: Sheet aluminum. Not less than .125 inch thick – face and sides. Precision routed with 2 inch deep return and is to be fully welded.

3. Character Height: As indicated on drawings.
4. Character Depth: As recommended by Manufacturer. Not less than 2" deep.
5. Finish: Baked Enamel to match Architect's sample.
6. Color: Refer to 'Material Finish / Color Schedule Section 000200' for color selections.
7. Font: As selected by Architect from Manufacturer's full line.
8. Mounting: Projected spacer mounting for Manufacturer's recommended distance from wall. Minimum 2-inch distance from wall.

9. Provide minimum of 3/16" translucent acrylic (Lexan) rear-face sheet. Attach characters to sheet metal back channels. Provide required to illuminate sign faces evenly.

10. Provide Manufacturer's standard white LED lighting including transformers, insulators and other components. Make provisions for servicing and concealing connections to building electrical system. Wiring for each letter is to extend directly back into the interior space with aluminum tube, finished to match the letters and secured. Wiring is not to extend from letter to letter. Transformers and other required electrical components are to be installed and concealed above nearest adjacent and accessible ceiling space. Do not mount in area without continuous ceiling.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

4. Internally brace signs for stability and for securing fasteners.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.5 ALUMINUM FINISHES

A. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are

pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 101419

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Room-identification signs.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For Room-identification signs.

   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples: Provide fully assembled full size sample for each type of sign product with colors and textures as specified.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in sign schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 SIGNS

A. Basis-of-Design Product: Subject to compliance with requirements, provide 9/16” thickness Modular Standard Sign System (as indicated on drawings) as manufactured by 2/90 Sign Systems Inc. (provide with tamper-resistant ends with spanner fasteners) or a comparable product by one of the following:

   1. ACE Sign Systems, Inc.
   2. Advance Corporation.
   3. APCO Graphics, Inc.
   4. ASE, Inc.
   5. ASI Sign Systems, Inc.

6. Best Sign Systems, Inc.
7. Fossil Industries, Inc.
8. Mohawk Sign Systems.
9. Stamprite Supersine; a division of Stamp Rite Inc.

B. Interior Panel Sign: Provide sign with smooth panel surfaces constructed with to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
   a. Subsurface Graphics: Subsurface ADA.
   b. Color: As selected by Architect from full range of industry colors.

2. Sign-Panel Perimeter: Finish edges smooth.

   a. Edge Condition: Square cut.
   b. Corner Condition in Elevation: Square.

3. Frame: Vertical retainers.

   a. Material: Aluminum.
   b. Profile: Square.
   c. Corner Condition in Elevation: Square.
   d. Finish and Color: As selected by Architect from manufacturer's full range.

4. Mounting: Surface mounted to wall with concealed anchors.
5. Size: As indicated on drawings.
6. Text: As indicated on drawings. Confirm with Owner prior to fabrication.
7. Lower Insert Material: Subsurface ADA
8. Upper Insert Material: Subsurface ADA
9. Window Insert: Paper as selected from manufacturer’s full range and clear Protective Lens. Color of channels of window insert as selected from manufacturer’s full range.
10. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8mm) above surface with contrasting colors as selected from manufacturer’s full range.

C. Refer to Signage Schedule for list of all signs.

2.3 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, Type UVF (UV filtering).

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors.
2. Furnish stainless steel fasteners.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace signs for stability and for securing fasteners.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Subsurface-Engraved Graphics: Reverse engrave back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

D. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
    1. Stainless-Steel Brackets: Factory finish brackets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate and install signs where indicated using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
5. Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent wall. Locate to allow approach within 36 inches (75 mm) of sign without encountering protruding objects or standing within the

swing of the door. Coordinate exact location with overall plan layout to be submitted for review with shop submittal.

B. Mounting Methods:
   1. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.

C. Remove temporary protective coverings and strippable films after construction is complete prior to turning over project to Owner.

END OF SECTION 101423

SECTION 101463 – ELECTRONIC MESSAGE SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Two, One Sided Electronic Message Signs with upper back-lit sign faces and sign cabinet.
   2. Control Software.

1.2 RELATED ITEMS

A. Electrical system provided under other Sections:

   1. Power conduit cables and outlet boxes.
   2. Signal raceways conduit and boxes.
   3. Pulling, signal wire, and terminators between electronic message sign and control locations.

1.3 REFERENCES

A. Standard for Electric Signs, UL-48, 13th Edition.
B. Standard for Control Centers for Changing Message Type Signs, UL-1433, 1st Edition.
C. Federal Communications Commission Regulation Part 15.
D. National Electric Code.

1.4 SUBMITTALS

A. Submit the following in accordance with Division 1 requirements:

   1. Manufacturer's product illustrations, data and literature.
   2. Shop drawings coordinated with electrical service installation.
   3. Maintenance data and operations manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store electronic message sign and equipment in clean, dry environment.

1.6 PROJECT CONDITIONS

A. Verify position and elevation of structure and its layout for electronic message sign equipment. Verify dimensions by field measurements.
B. Installation may proceed in acceptable weather conditions.

1.7 QUALITY ASSURANCE

A. For outdoor use.

B. Obtain electronic message sign and related equipment through single source from a single manufactuer.
C. ETL listed per UL Standards 48 and 1433.
D. NEC Compliant.
E. FCC Compliant.
F. ETLC listed to CAN/CSA 22.2.

1.8 WARRANTY/SERVICE PLAN

A. Provide 5 year labor and material warranty.
B. Replace electronic modules or components that fail during the coverage period.
C. Parts support for 10 years.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Basis of design: Subject to compliance with requirements, provide “Galaxy GS6 Series 15.85mm” as manufactured by Daktronics or approved equal.

2.2 PRODUCT

A. Daktronics GS6-40x100-15.85-RGB-2V; Two, one sided electronic message signs capable of displaying text, graphics and animations in 281 trillion colors, with same content displayed on both signs.

2.3 ELECTRONIC MESSAGE SIGN

A. General Information
    1. Dimensions: 2’-7” x 5’-6” x 5” (each face).
    2. Weight: 105 lbs. (each face)
    3. Maximum watts per face: 515W
    4. Cabinet color: black.
B. Construction
    1. Display area is to be comprised of 25” x 63” matrix (40 pixels high by 100 pixels wide); Two rows of 4 modules.
    2. Each module is to contain an array of 20 pixels high by 25 pixels wide.
    3. All LED display modules shall be identical in construction and interchangeable throughout the display.
    4. Display modules shall have a minimum of 90 degree vertical and 140 degree horizontal viewing angle (half-intensity).
    5. Horizontal louvers are to be placed between rows of pixels to improve contrast.
    6. Each pixel is to be comprised of (1) red, (1) green and (1) blue LED.
    7. Pixels are to be placed on a .62” (15.85mm) center-to-center pitch.
    8. Sign face is to be front accessible for service.
C. Capabilities
    1. Able to display up to five lines of twenty 4” characters using a seven pixel high font.
    2. Utilization of full matrix shall allow characters of up to 25” in height.
    3. Able to display text, graphics, logos, basic animation, video clips, multiple font styles & sizes.

4. Able to maintain the full color pallet of 281 trillion colors at any dimming level.
5. Able to display temperature (through the use of an external temperature sensor), date, and time.
6. Shall be connected to a light sensor allowing each LED display to automatically adjust brightness according to display direction and lighting conditions, providing 64 levels of dimming.

D. Control and Communications:
   1. The display controller should be DHCP-enabled and allow for static IP addressing.
   2. Each single-face display shall be controlled and monitored by its own LED controller.
   3. The LED controller shall be able to receive instructions from and provide information by accessing the Venus Control Suite using the following communication modes:
      a) Ethernet Communication: TCP/IP over Ethernet (Cat5 cabling).

E. Upper ID cabinet sign:
   1. Refer to drawings.
   2. Sign is to be backlit (UL listed).
   3. Refer to drawings for overall cabinet size, graphics, fonts and colors.

2.4 CONTROL SOFTWARE.

A. Provide Daktronics “Venus Control Suite” or approved equal. Control software to provide the following minimum features:

   1. HTML based or “web based”.
   2. Compatible with major internet browsers.
   3. Spell Check for content creation.
   4. Text filter to prevent the use of select words during message creation.
   5. Import a single or series of images and graphics from a variety of formats.
   6. Frame-by-frame user selectable presentation effects for entry, hold, and exit transitions.
   7. Creation of custom animation through in-program editing tools.
   8. Message scheduling to allow pre-programmed start and stop times of messages more than one year in advance.
   9. Multiple messages can run on the display simultaneously, alternating between one and the next.
   10. Addition of temperature, date, and time to any message in a variety of formats.
   11. Built-in test sequence for display troubleshooting.
   12. Automatic adjustment for daylight savings time.
   13. System is to be installed to tie-in with existing ethernet network.
   14. Software must be Windows compatible.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that mounting structure is ready to receive electronic message sign. Verify that placement of conduit and junction boxes are as required.

3.2 INSTALLATION

A. All conduit, boxes, connectors, power, control cable, etc. to electronic message sign is to be provided by this contract. Provide a complete installation ready for use.

B. Provide and install electronic message sign and signage cabinet with backlit signage in accordance with manufacturer's instructions. Verify unit is plumb and level.
C. Verify Earth Ground does not exceed 10 ohms.

3.3 INSTALLATION – CONTROL LOCATION

A. Provide boxes, cover plates and jacks as required.

3.4 TRAINING

A. Perform one operator training session with up to three end-user identified operators.

END OF SECTION 101463

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall guards.
2. Corner guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of wall and corner protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Material certificates.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.2 WALL GUARDS

A. Crash Rail: Heavy-duty, assembly consisting of continuous snap-on plastic cover installed over concealed retainer; designed to withstand impacts.

1. Basis-of-Design Product: Construction Specialties, Inc. “4000 Model SCR-40N” 4” high surface mounted crash rail, or a comparable product by one of the following:

2. Manufacturers:

a. American Floor Products Co., Inc.
b. ARDEN Architectural Specialties, Inc.
c. Balco, Inc.
d. InPro Corporation
e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
f. Korogard Wall Protection Systems; Division of RJF International Corporation.
g. Pawling Corporation.
h. Tepromark International, Inc.

3. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; in dimensions and profiles indicated on Drawings.

a. Surface: Uniform.
b. Color and Texture: Refer to Material Color / Finish Schedule specification section 000200.

4. Continuous Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
5. Retainer Clips: Manufacturer's standard impact-absorbing clips designed for heavy-duty performance.
6. Bumper: Continuous, resilient bumper cushion(s).
7. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
8. Accessories: Concealed splices and mounting hardware.
9. Mounting: Surface mounted directly to wall.

2.3 CORNER GUARDS

A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn or match angle of wall.

1. Basis-of-Design Product: Construction Specialties, Inc. “SSM-20N” series partial height acrovyn corner guard (angle to match wall angle), or a comparable product by one of the following:

2. Manufacturers:

   a. American Floor Products Co., Inc.
   b. ARDEN Architectural Specialties, Inc.
   c. Balco, Inc.
   d. InPro Corporation
   e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   f. Korogard Wall Protection Systems; Division of RJF International Corporation.
   g. Pawling Corporation.
   h. Tepromark International, Inc.

3. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness;

   a. Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius.
   b. Height: 4 feet (1.2 m).
      1) Provide 3 feet high unit at partial height walls.
   c. Color and Texture: As selected by Architect from manufacturer's full range. Multiple colors may be selected for guards to match wall paint color.

4. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, 1-piece, extruded aluminum.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: As recommended by protection product manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm) apart.
3. Adjust end and top caps as required to ensure tight seams.

END OF SECTION 102600

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Washroom accessories.
2. Underlavatory guards.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule:

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 WASHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

B. Grab Bar: TA-1, TA-2, TA-3.

1. Basis-of-Design Product: Bobrick B-5806.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4, satin finish.

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

C. Mirror Unit: TA-4

1. Basis-of-Design Product: Bobrick B-290.
2. Frame: Stainless-steel angle.

    a. Corners: Mitered and mechanically interlocked.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: As indicated on drawings. If not indicated, provide 24”W x 48”H.

D. Toilet Tissue Dispenser: TA-7
1. Basis-of-Design product: Bobrick B-6677
2. Mounting: Recessed mounted.
3. Material: Stainless steel.
4. Provide theft resistant toilet tissue spindle.

E. Soap Dispenser: TA-8
1. Basis-of-Design product: Bobrick B-818615
2. Mounting: Surface mounted.
3. Material: Stainless steel.

F. Surface Mounted Sanitary Napkin Disposal: TA-11
1. Basis-of-Design product: Bobrick B-353
2. Mounting: Recessed mounted.
3. Material: Stainless steel.

G. Paper Towel Dispenser: TA-5
1. Basis-of-Design product: B-72974
2. Mounting: Surface mounted.
3. Operation: Battery Operated (provide 4 “D” size alkaline batteries).

H. Clothes Hook: TA-13
1. Basis-of-Design product: Bobrick 76717.
2. Finish: Stainless steel No. 4 finish (satin).

I. Baby changing Station: TA-9
1. Basis-of-Design product: Koala Kare KB-110-SSRE
2. Mounting: Recessed mounted.
3. Material: Stainless steel exterior, high density grey polyethylene interior.

J. Combination Paper Towel Dispenser / Waste Receptacle: TA-10
1. Basis-of-Design product: Bobrick B-3974
2. Mounting: Semi-Recessed mounted.
3. Operation: Battery Operated (provide 4 “D” size alkaline batteries).

K. Mop Shelf: TA-12
1. Basis-of-Design product: Bobrick B-224
2. Mounting: Surface mounted.

3. Material: Stainless steel.
4. Provide with (4) mop holders and 3 rag hooks.
5. Length: 36 inches.

2.2 UNDERLAVATORY GUARDS: TA-6

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

B. Underlavatory Guard:

1. Description: Provide insulating pipe covering for supply and drain piping assemblies. The install lavatory protective enclosure that prevent direct contact with and burns from piping. Provide 'Lav Shield' as provided by Truebro (IPS Corporation) model #2018 or approved equal with tamper resistant screws. Provide factory cut models where available (coordinate with mechanical).
2. Material and Finish: Impact-resistant, stain-resistant and chemical resistant rigid vinyl with China white finish.

C. Provide at all wall mounted lavatories and as noted on drawings.

2.3 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire protection cabinets for fire extinguishers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified.

D. Maintenance data.

1.3 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Basis-of-Design: Subject to compliance with requirements, provide Larsen's Manufacturing Co., Architectural Series, Model #SS-2409-R3, or equal by one of the following:

    a. Fire End & Croker Corporation;.
    b. J. L. Industries, Inc., a division of Activar Construction Products Group;.
    c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;.
    d. Modern Metal Products, Division of Technico Inc.; Insert product name or designation.
    e. Moon-American;.
    f. Potter Roemer LLC;.
    g. Watrous Division, American Specialties, Inc.

B. Cabinet Construction: Nonrated. Provide fire-rated cabinets when located in fire-rated walls.

C. Cabinet Material: Stainless-steel sheet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
    1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Stainless-steel sheet.

F. Door Material: Stainless-steel sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

    a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

        1) Location: Applied to cabinet door.
        2) Application Process: Engraved.
        3) Lettering Color: Black.
        4) Orientation: Vertical.

K. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
   a. Interior of cabinet.

2. Stainless Steel: No. 4.

2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Miter and weld joints and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.

B. Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

C. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Larsen's Manufacturing Co. "MP5-A" fire extinguisher (U.O.N) or comparable product by one of the following:

    a. Amerex Corporation.
    b. Ansul Incorporated; Tyco International Ltd.
    c. Badger Fire Protection; a Kidde company.
    d. Buckeye Fire Equipment Company.
    e. Fire End & Croker Corporation.
    f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    h. Moon-American.
    i. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
    j. Potter Roemer LLC.
    k. Pyro-Chem; Tyco Safety Products.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

    1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

C. All fire Extinguishers to be installed in cabinets at locations shown on drawings.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Knocked-down wardrobe lockers.

1.2 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and locker identification system and numbering sequence.

C. Samples: For each color specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.2 KNOCKED-DOWN WARDROBE LOCKERS

A. Basis of Design: Subject to compliance with requirements, provide List Industries “Superior Standard Quiet KD Lockers” or equal, by the following:
   1. Art Metal.
   2. ASI Storage Solutions.
   3. General Storage Systems.
   4. Lyon Workspace Products.
   5. Penco Products, Inc.

B. Configuration: Double tier lockers. 12” Wide x 12” Deep x 72” High.

C. Doors: One piece; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
   1. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.
   2. Door Style: Vented panel as follows:
      a. Concealed Vents: Slotted perforations in top and bottom horizontal door return flanges.

D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

   1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch (0.61-mm) nominal thickness, with single bend at sides.
   2. Backs and Sides: 0.024-inch (0.61-mm) nominal thickness, with full-height, double-flanged connections.
   3. Shelves: 0.024-inch (0.61-mm)nominal thickness, with double bend at front and single bend at sides and back.

E. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

F. Hinges:
   1. Continuous Hinges: Manufacturer's standard, steel, full height.

G. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

   1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
      a. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism.

H. Locks: No built in lock. Provide hasp for Owner’s provided locks.

I. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

J. Hooks: Manufacturer's standard ball-pointed type hooks, aluminum or steel; zinc plated.

K. Continuous Zee Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch (1.52-mm) nominal-thickness steel sheet.

1. Height: 4 inches (102 mm)] <Insert dimension>.

L. Filler Panels: Fabricated from 0.036-inch (0.91-mm) nominal-thickness steel sheet.

M. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

N. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

O. Finish: Baked enamel or powder coat.

1. Color: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Equipment: Provide each locker with an identification plate and the following equipment:
1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

F. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

G. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

H. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.

B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
1. Attach filler panels with concealed fasteners.

END OF SECTION 105113

SECTION 105500.16 – LIBRARY RETURN BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior Thru-Wall Return System
2. Interior Thru-Wall Return System

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For postal specialties. Include plans, elevations, sections, and attachment details.

C. Samples: For each type of exposed finish.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Furnish lock keys with temporary identification for their respective locks, bagged, and securely taped inside the collection compartment for shipping.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXTERIOR THRU-WALL RETURN SYSTEM

A. Exterior thru-wall mounted book and media return box: Consisting of multiple chutes with weather hoods and depository doors.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kingsley Companies Ease DualDrop ThruWall System ’18-8700’ or comparable product by one of the following:
   a. American Book Returns, Inc.
   b. EZ Drop

2. Exterior Faceplate: Formed of 16-gauge stainless steel with visual lettering and braille tags.
3. Chute Housing Top and Bottom: Formed of 18-gauge aluminum.
4. Water Trough: Formed of 20-gauge aluminum.
5. Air Barrier: Neoprene rubber panel.
6. Interior Trim: Formed of 16-gauge aluminum
   a. Finish: Manufacturer’s standard brushed finish.
7. Identification: Engrave exterior faceplate with 1-inch high letters as follows “Books” and “Media” and corresponding braille tags.
8. Locking: Provide mechanical locking mechanism with visual indicator for each door controlled from interior of building.

2.2 INTERIOR THRU-WALL RETURN SYSTEM

A. Interior thru-wall mounted book return box: Consisting of a single chute .

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kingsley Companies Ease Interior ThruWall System ’10-8105’ or comparable product by one of the following:
   a. American Book Returns, Inc.
   b. EZ Drop

2. Faceplate: Formed of 0.040-inch aluminum with flat profile and upward opening depository door built into chute.
3. Chute Housing: Formed of 0.040-inch aluminum with integrated slide.
4. Interior Trim: Formed of 16-gauge aluminum
   a. Finish: Manufacturer’s standard brushed finish.
5. Identification: Engrave exterior faceplate with 1-inch high letters as follows “Library Return”.
6. Locking: Provide mechanical locking mechanism for door controlled from secure side of box.

2.3 ACCESSORIES

A. Dual Drop Extension Kit for exterior wall thickness as noted on drawings.

2.4 FABRICATION

A. Form return system boxes to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

B. Preassemble return system boxes in shop to greatest extent possible to minimize field assembly.

C. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Thru-Wall Return Systems: Install return system boxes at heights and locations as indicated on drawings with centerline of return slots not more than 48 inches (1219 mm) above finished floor.

END OF SECTION 105500.16

SECTION 107516 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Delegated-Design Submittal: For flagpoles.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.

B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is 90 mph (40 m/s) 3-second gust speed at 33 feet (10 m) aboveground.

2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).

1. American Flagpole; a Kearney-National Inc. Company.
2. Concord Industries, Inc.
3. Lingo Inc.; Acme Flagpole Division.
4. Michigan Flagpole Inc.
5. Rocket Enterprise, Inc.

B. Exposed Height: 30 feet (9 m).

C. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch (1.52-mm) wall thickness with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

2.4 FLAGS

A. Provide the following flags for outdoor use with UV protection, embroidered, lock-stitched, constructed of nylon:
1. United States of America; 5’ x 8’ in size.

2.5 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch (1.6-mm) spun aluminum, finished to match flagpole.

B. Internal Halyard, Cam Cleat System: 5/16-inch- (8-mm-) diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

C. Halyard Flag Snaps: Provide two swivel snap hooks per halyard.

2.6 MISCELLANEOUS MATERIALS

A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

B. Sand: ASTM C 33/C 33M, fine aggregate.

C. Elastomeric Joint Sealant: Single-component urethane or single-component neutral-curing silicone joint sealant complying with requirements in Division 7 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.7 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

D. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

E. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete". Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 107516

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes manual dual roll shades and motorized shade operators.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, details of installation, operational clearances, wiring diagrams, and relationship to adjoining Work.

1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

C. Coordination Drawings: Drawn to scale and coordinating penetrations and ceiling-mounted items.

D. Samples: For each exposed finish and for each color and texture required.

E. Window Treatment Schedule: Use same designations indicated on Drawings.

F. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Fire-Test-Response Characteristics: Provide products passing flame-resistance testing according to NFPA 701 by a testing agency acceptable to authorities having jurisdiction.

C. Comply with WCMA A 100.1.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROLLER SHADES

A. Products: Subject to compliance with requirements, provide one of the following:

B. Basis-of-Design Product: Vertical roll-up, single and dual roller window shade. Dual roller window shades will have different types of fabric on each roller. Housing will be extruded aluminum, including brackets, fasteners, and other components necessary for complete installation. Subject to compliance with requirements, provide shades as manufacturer by Draper, Inc. as follows or other manufacturers, listed below:
   1. Dual roller, manually operated, roller shades (Type 'A'):
      a. Draper, Inc. - Access Dual Roller FlexShade.
      b. Mounting: Concealed or Surface Mount, as indicated on drawings.
      c. Provide with dual shades – Sunscreen and Room Darkening.

   2. Single roller, manually operated, roller shades (Type 'B'):
      a. Draper, Inc. – Manual FlexShade.
      b. Mounting: Concealed or Surface Mount, as indicated on drawings.
      c. Provide with dual shades – Sunscreen and Room Darkening.

   3. Or approved equal prior to bidding by one of the following:
      a. Hunter Douglas, Inc.; Hunter Douglas Window Fashions Division.
      b. Levolor; Levolor-Kirsch Window Fashions; a Newell Rubbermaid Company.
      c. Lutron Shading Solutions by VIMCO.
      d. MechoShade Systems, Inc.

C. Shade Band Material:
      a. Sunscreen
         1) Material: SheerWeaver Series PW4550 (Phifer).
         2) Color: As designated on Material Finish / Color Schedule.
         3) Content: 83% vinyl, 17% polyester core
         4) Material Openness Factor: 5 percent.
         5) Weight / Sq. Yard: 12.5 oz.; Thickness: .025 in.
         6) UV Fade: none; UV Tensile: 96 percent

      b. Room Darkening
         1) Material: SunBloc Series SB9100 (Duopak)
         2) Color: As designated on Material Finish / Color Schedule.
         3) Material Openness Factor: 100 percent opacity.
         4) Weight / Sq. Yard: 12 oz..
         5) UV Fade: none; UV Tensile: 96 percent

D. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

   1. Chain-Retainer Type: Clip, jamb mount.
   2. Spring Lift-Assist Mechanisms: Provide for shadebands that weigh more than 10 lb (4.5 kg)] or for shades as recommended by manufacturer, whichever criterion is more stringent.

E. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.

F. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

G. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

H. Method of installation:
1. At locations where ceiling is directly adjacent to the shade housing, the unit is to be recessed in ceiling and surface mounted to wall with screws or other acceptable means of attachment. At these locations provide pocket-style headbox. Refer to drawings for locations.
   a. Housing Case:
      1) Rectangular enclosure for two rollers fabricated from extruded aluminum with white paint finish and stamped steel end caps
      2) Housing designed to be installed separately from shade as part of ceiling system installation. Shade and operating mechanism can be site installed later after construction operations that might damage shade are complete.
      3) Closure panel: Bottom closure panel forms slot for passage of shades and is removable for access to shades and operating mechanisms.
      4) Bottom perimeter flange provides support and trim for acoustical ceiling panels.

2. At locations where no ceiling is directly adjacent to the shade housing, the unit is to be surface mounted to wall with screws or other acceptable means of attachment. At these locations provide finished snap on fascia and end caps. Refer to drawings for locations.

2.2 ROLLER SHADE FABRICATION

A. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch (6 mm) from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
3. Unit sizes are to be as indicated on the drawings or to the maximum size that the material permits to minimize the number of units. Units are to be symmetrical within all spaces when one unit will not suffice.

B. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

C. Bottom shade slat: Minimum 1/8 by 1 inch (3 mm by 25 mm) aluminum slat encased in heat seamed hem.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field verify window dimensions prior to fabrication.

B. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

C. Coordinate requirements for power supply, conduit, and wiring required for window shade motors and controls.

D. Prior to installation, verify type and location of power supply.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Connections: Connect motorized operators to building electrical system.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 01 Section Demonstration and Training."

END OF SECTION 122413

SECTION 123216 – MANUFACTURED CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured casework, countertops and accessories.
B. Solid surface countertops.

1.2 RELATED SECTIONS

A. Division 6 - Carpentry: Framing and blocking in walls, floors and ceiling to support equipment.

B. Division 9 - Resilient Flooring: base for casework including floor cabinets and table legs.

C. Division 22: Sinks, faucets, fittings, traps, stops, tail pieces, vacuum breakers, and other fixtures, electrical and mechanical runs and connections.

D. Division 26: Connections for electrical service lines, wire and conduit to service fixtures.

1.3 REFERENCES

A. ADA (ATBCB ADAAG): Americans with Disabilities Act Accessibility Guidelines.

B. ANSI 208.1: Standards for Particleboard.

C. Architectural Woodwork Institute (AWI): Quality Standards.

D. NEMA LD 3: High Pressure Decorative Laminates.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Test reports certifying that the casework finish complies with manufacturer's standards for chemical and physical resistance performance requirements.
   2. Performance test reports from an independent testing lab on each specified top material.
   3. Preparation instructions and recommendations.
   4. Storage and handling requirements and recommendations.
   5. Installation methods.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Indicate locations of blocking and reinforcements required for installing casework.
   2. Include indicators of exposed conduits, if required, for service fittings.
   3. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other equipment.
   4. Include coordinated dimensions for equipment specified in other Sections or provided by Owner.

C. Certifications:

1. Submit certified product test data in accordance with ANSI A161.1, NEMA LD3, and general static load testing as specified, performed and certified by an independent testing agency.
2. Submit certification stating that all casework will comply with AWI's "Architectural Woodwork Quality Standards".

3. Material Samples: For each finish selected.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Not less than 5 years experience in the actual production of specified products. Submit documentation of plant facilities and capacity to provide casework for this Project.

B. Installer Qualifications: Firm with 5 years experience in installation or application of systems similar in complexity to those required for this Project, plus the following.
   1. Authorized distributor of manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Casework shall be protected in transit.

B. Store products under cover in a ventilated building not exposed to extreme temperature and humidity changes prior to installation. Do not store or install casework in building until concrete, masonry, and drywall/plaster work is dry.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction if applicable.

1.7 PROJECT CONDITIONS

A. For delivery and installation of casework and equipment, building conditions shall comply with AWI Standard 1700-G-3 and 1700-G-4 and be as follows:
   1. Flooring required to be placed under casework and equipment installed.
   2. Wood or metal blocking (wall grounds) installed within partitions to allow for immediate installation upon delivery.
   3. Heating and air conditioning systems providing consistent temperature and humidity conditions to comply with by AWI Standard 1700-G-4 and 1700-G-5.
      a. Relative humidity not less than 40 percent, nor more than 60 percent.
      b. Temperatures not less than 65 degrees F (18 degrees C) and not greater than 80 degrees F (27 degrees C) in areas of casework and equipment installation.
   4. Overhead mechanical, electrical and plumbing rough-in work is complete.
   5. Wet operations complete prior to delivery.
   6. Ceiling grids (with or without ceiling tiles), overhead soffits, ductwork and lighting installed.
   7. Painting complete.

1.8 WARRANTY

A. Casework Manufacturer Warranty: 5 years from date of delivery. Warranty is for the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly investigate and address said deficiencies.

1. Defects in materials and workmanship.
2. Deterioration of material and surface performance below minimum standards as certified by independent third party testing laboratory.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide manufactured casework by Case Systems, Inc. or other approved equal product including but not limited to the following:

1. TMI Systems Design Corporation.
2. Or approved equal.

2.2 DESIGN

A. Flush Overlay Door Design:
1. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8 inch (3.2 mm) reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet

B. Interior woodwork grade: AWI, custom grade

C. ADAAG, Americans with Disabilities Act Requirements: The following requirements shall be met.
1. Countertop height: With or without cabinet below, not to exceed a height of 34 inches (864 mm) A.F.F., (Above Finished Floor), at a surface depth of 24 inches (610 mm).
2. Kneespace clearance: Shall be minimum 29 inches (737 mm) A.F.F. at apron, and 30 inches (762 mm) clear span width.
3. 12 inches (305 mm) deep shelving, adjustable or fixed: Not to exceed a range from 9 inches (229 mm) A.F.F. to 54 inches (1372 mm) A.F.F.
4. Wardrobe cabinets: Shall be furnished with rod/shelf adjustable to 48 inches (1219 mm) A.F.F. at a maximum 21 inches (533 mm) shelf depth.
5. Sink cabinet clearances: In addition to above, upper kneespace frontal depth shall be no less than 8 inches (203 mm), and lower toe frontal depth shall be no less than 11 inches (279mm), at a point 9 inches (229 mm) A.F.F., and as further described in Volume 56, Section 4.19.

2.3 PERFORMANCE

A. Casework shall conform to the following minimum performance requirements for static load performance:
1. Base cabinet construction/racking test: 800 lbs. (363 kg).
2. Cabinet front joint loading test: 425 lb (193 kg).
3. Wall cabinet static load test: 2,000 lb (907 kg).
4. Drawer front joint loading test: 600 lb (272 kg).
5. Drawer construction/static load test: 750 lb (340 kg).
6. Cabinet adjustable shelf support device/static load test: 300 lb (136 kg).

2.4 MATERIALS AND COMPONENTS

A. Laminated Plastics/Finishes:
1. High-pressure plastic laminate, .030 inch (.76 mm) in thickness, for exterior surfaces shall meet NEMA LD3-2000 VGL standards including thickness.
a. Exterior Color:
1) Refer to 'Material Finish / Color Schedule Section 000200' for color selections
2) Where wood grain laminates are used, direction of wood grain shall be vertical on door, end panels, fascia panels, and exposed backs; horizontal on drawer faces, aprons, and top rails.
2. Plastic Laminate Balancing Sheet: White high-pressure cabinet-liner, .020 inch (.051 mm) in thickness shall meet NEMA LD3-2000 CLS standards. Provide for balancing exterior surface laminates.
3. Countertop High-Pressure Plastic Laminate:
a. High-pressure plastic laminate, textured finish .050 inch (1.27 mm) thickness.
b. Countertop Colors:
1) As indicated in Material Finish / Color Schedule.
c. Heavy gauge neutral colored backing sheet for balanced construction.
4. Pressure Fused Laminate (for concealed surfaces):
a. Melamine resin impregnated, 120 gram PSM minimum, thermofused to core under pressure.
b. Comply with NEMA LD3-2000 VGL standards and NEMA LD3-2000 CLS standards.
c. White pressure fused laminate for cabinet interiors behind door and drawers and interiors of all closed cabinets.
d. Balanced at all concealed surfaces with same thermofused melamine. Unsurfaced coreboard or simple backers not allowed.

B. Core Materials: Particleboard, minimum 47 lb. (21.3 kg) density, of balanced 3-ply construction with moisture content not to exceed 8 percent. Particleboard shall conform to ANSI A208.1, Grade M-3.

C. Edging Types: Provide one or more of the following in accordance with "Edging Locations":
1. 3 mm thick PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, automatically trimmed, inside/outside length-radiused for uniform appearance, buffed and corner-radiused for consistent design.

D. Edging Locations. Provide the above specified edging types at the following locations, of the following colors:
1. Door/Drawer-Front edging shall be 3mm PVC.
a. Color selected by Architect to match adjacent laminates.
2. Forward edge of cabinet end panel, top, bottom, door/drawer front spacer rail, interior dividers, and shelf shall be 3mm PVC.
a. Color selected by Architect to match adjacent laminates.

E. Hardware
1. Hinges:
a. 2 ¾ inch, 5-knuckle steel butt hinges made from 0.095 inch thick metal with hospital tip.
2. Pulls: Comply with ADA requirements.
a. Wire design, 4 inches (101.6 mm):
1) Stainless Steel.

3. Drawer Slides:
   a. Standard Drawers: Self-closing design, epoxy powder coated White, with positive in-stop, out-stop, and out-keeper to maintain drawer in 80 percent open position. Captive nylon rollers, front and rear. Minimum dynamic (operational) load rating of 100 pounds (45 kg) at 50,000 cycles.
   b. File Drawers: Full extension, 3-part progressive opening slide, minimum 100 lb (45 kg), zinc plated or epoxy coated at manufacturer's option.
      1) Provide body mounted molded rails for hanging file system for legal or letter size as indicated. Cutting or machining of drawer body/face not allowed.
   c. Paper Storage Drawers: Full extension, 3-part progressive opening slide, minimum 100 lb (45 kg), zinc plated or epoxy coated at manufacturer's option.
4. Catches: Catch shall provide opening resistance in compliance with the Americans with Disabilities Act.
   a. Provide top-mounted magnetic catch for base and wall cabinet door. Provide two at each tall cabinet door. Catch housing shall be molded in White. LH-340ADA.
   b. LH-345 Roller catch for mobile cabinets.
5. Adjustable Shelf Supports: Design shall include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip. Load rating shall be minimum 300 lb (136 kg) each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection.
6. Wardrobe Rod: Shall be 1-1/16 inches (27 mm) rod, supported by LH-363 flanges.
7. Coat Hooks:
   a. Double coat hooks, wall mount.
8. Locks: Shall be 5 disc tumbler lock keyed alike and master keyed. Dull chrome finish. Lock core shall be removable.

2.5 CABINET CONSTRUCTION

A. Workmanship:
   1. Exposed exterior cabinet surfaces shall be .030 inch (.76 mm) high-pressure laminate. Laminate surface/balancing liner to core under controlled conditions by approved and regulated laminating methods to assure a premium lamination. Natural-setting hybrid P.V.A. Type III water resistant adhesives that cure through chemical reaction, containing no health or environmentally hazardous ingredients, shall be used.
      a. Methods requiring heat are not allowed.
      b. "Contact" methods of laminating are not allowed.
   2. Cabinet parts shall be accurately machined and bored for premium grade quality joinery construction utilizing automatic machinery to insure consistent sizing of modular components. End panels shall be doweled to receive bottom and top.
   3. Back panel shall be fully bound (dadoed) into, and recessed 7/8 inch (22.2 mm) from the back of cabinet sides, top, and bottom to insure rigidity and a fully closed cabinet. Cabinet back shall be mechanically fastened from rear of body for tight interior fit and sealed with full-perimeter high-strength hot-melt adhesive.
   4. Drawer bottom shall be fully bound (dadoed)and glued into and recessed 1/2 inch (12.7 mm) up from the bottom of sides, back, and sub-front. Sides of drawer shall be doweled to receive drawer back and sub-front.
   5. 3/4 inch (19.1 mm) thick hang rails shall be mechanically fastened to end panels of all wall, base, and tall cabinets for extra rigidity and to facilitate installation.
   6. All cases shall be square, plumb, and true.
   7. Provide removable back panels and closure panels for plumbing access at sink cabinets, and where required.

B. Detailed Requirements For Cabinet Construction:
   1. Sub-Base:
      a. Cabinet sub-base shall be separate and continuous water resistant exterior grade plywood with concealed fastening to cabinet bottom. Ladder-type jobsite construction of individual front, back, and intermediates, to form a secure and level platform to which cabinets attach. No cabinet sides-to-floor will be allowed.
      b. Sub-base at exposed cabinet end panels shall be recessed 1/4 inch (6.4 mm) from face of finished end, for flush installation of finished base material by other trades.
   2. Structural Cabinet Body:
      a. Cabinet parts shall be accurately machined and bored for premium grade quality joinery construction utilizing automatic machinery to ensure consistent sizing of modular components. Dowel end panels to receive bottom and top.
      b. Cabinets over 36 inches (914 mm) wide shall be furnished with a mechanically fastened, yet removable, vertical divider to reduce horizontal member/shelf deflection. Wall cabinets shall have a clear inside nominal depth of 12 inches (305 mm) unless detailed otherwise.
   3. Cabinet Top and Bottom:
      a. Solid sub-top shall be furnished for all base and tall cabinets.
      b. At cabinets over 36 inches (914 mm), bottoms and tops shall be mechanically joined by a fixed divider.
      c. Exterior exposed wall cabinet bottoms shall be Pressure Fused white laminate both sides. Assembly devices shall be concealed on bottom side of wall cabinets.
   4. Cabinet Ends:
      a. Holes drilled for adjustable shelves 1-1/4 inches (32 mm) on center.
      b. Exposed exterior cabinet ends shall be laminated with high-pressure plastic laminate, balanced with high-pressure cabinet-liner interior surface.
   5. Fixed And Adjustable Shelves:
      a. Thickness shall be 1 inch.
      b. Shelves shall meet the loading/deflection standards of the National Particleboard Association.
   6. Cabinet Backs:
      a. Cabinet backs shall be minimum 1/2 inch (12.7 mm) thick, inset from rear of body, and fully bound (dadoed) four sides. Rear, unexposed, side of back perimeter shall be toe-nailed with mechanical fasteners for tight interior fit and direct connection of back panel to body, and sealed with full-perimeter high-strength hot-melt adhesive.
      b. Provide 3/4 inch (19 mm) thick hang rails fastened to back/body as specified in this Section. Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of 2 at base, 2 at wall, and 3 at tall cabinets.
      c. Exposed exterior backs shall be high-pressure plastic laminate balanced with high-pressure cabinet-liner.
   7. Door And Drawer Fronts:
      a. Overlay Design: Laminated door and drawer fronts shall be 13/16 inch (20.6 mm) thick for all hinged and sliding doors. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8 inch (3.2 mm) reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet. Laminated door and drawer fronts shall be 13/16 inch (20.6 mm) thick for all hinged and sliding doors.
      b. Front Rail: Provide minimum 3/4 inch (19.1 mm) by 6 inches (152 mm) by full width

cabinet body rails immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, close off reveal, and be locator for lock strikes.

8. Drawers:
   a. Drawer fronts shall be applied to separate drawer body component sub-front.
   b. Drawer sides shall be doweled and glued to receive front and back, machine squared and held under pressure to set.
   c. Typical 1/2 inch (12.7 mm) drawer bottom, recessed, shall be fully bound (dadoed) into front, sides, and back. Routing, in drawer body for bottom, shall receive continuous glue.
   d. Reinforce drawer bottoms with 1/2 inch (12.7 mm) by 4 inches (101.6 mm) front-to-back intermediate underbody stiffeners, mechanically fastened. One at 24 inches (610 mm), two at 36 inches (914 mm), and over.
   e. Paper storage drawers shall be fitted with full width hood at back.
9. Vertical and Horizontal Dividers:
   a. Natural hardboard 1/4 inch (6.4 mm) thick, smooth both faces. Secured in cabinet with molded plastic clips.

2.6 COUNTERTOP CONSTRUCTION

A. Refer to Section 123623.13 – Plastic Laminate Clad Countertops and Section 123661.16 – Solid Surfacing Countertops.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not store or install casework in facility until concrete, masonry, drywall and plaster work is dry within limits acceptable to the casework manufacturer.

B. Do not begin installation until substrates have been properly prepared.
   1. Walls and openings are plumb, straight and square.
   2. Concrete floors level within 1/8 inch (3 mm) level per 10 foot (3000 mm) run, non-accumulative, when tested with a straight edge in any one direction.

3.2 COORDINATION

A. Verify site dimensions of cabinet locations in building prior to fabrication.

B. Coordination with Mechanical, Plumbing and Electrical Contractors: Coordinate work of this Section with work of other Sections including but not limited to:
   1. Water, piping, electrical devices, and wiring.
   2. Installation of fittings according to Shop Drawings and manufacturer's written instructions.
   3. Setting bases and flanges of sink and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material.
   4. Anchorage of fittings and piping, unless otherwise indicated.

3.3 INSTALLATION

A. Install casework in accordance with manufacturer's instructions.
   1. Installation of casework shall be plumb, level, true and straight, with no distortions.
   2. Use concealed shims as required.
   3. Where casework or equipment butts against other finished work, scribe and cut for an accurate fit.
   4. Lubricate operating hardware as recommended by the manufacturer.

B. Install countertop and edge surfaces in one plane with flush hairline. Locate joints only where shown on Shop Drawings.
   1. Provide required holes and cutouts for service fittings.
   2. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.
   3. Provide scribe moldings for closures at junctures of countertop, curb, and splash, with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
   4. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.4 PROTECTION

A. Inspect casework for damaged or soiled areas; remove, refinish, and touch-up as required.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Substantial Completion.

D. Remove cartons, debris, sawdust, scraps and similar items and leave spaces clean, and casework ready for Owner's use.

E. Provide the services of a qualified manufacturer's representative to demonstrate operation and maintenance procedures of the installed casework and equipment to the Owners personnel.

END OF SECTION 123216

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic-laminate countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

1. Plastic laminates, for each color, pattern, and surface finish.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

B. Grade: Custom.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.
b. Nevamar; a Panolam Industries International, Inc. brand.
c. Pionite; a Panolam Industries International, Inc. brand.
d. Wilsonart.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated in Material Finish / Color Schedule Section 000200.

E. Edge Treatment: 3-mm PVC edging.

F. Core Material at Sinks: exterior-grade plywood.

G. Core Thickness: 3/4 inch (19 mm).

1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Particleboard: ANSI A208.1, Grade M-2.
2. Softwood Plywood: DOC PS 1.

2.3 ACCESSORIES

A. Grommets for Cable Passage through Countertops: 1-1/4-inch (32-mm) OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Doug Mockett & Company, Inc.

2.4 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to 1/16” radius.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Secure backsplashes to walls with adhesive.
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

END OF SECTION 123623.13

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material interior window sills.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Affinity Surfaces; a brand of Domain Industries, Inc.
b. Avonite Surfaces.
c. DuPont Corian
d. LG Chemical, Ltd.
e. Meganite Inc.
f. Samsung Chemical USA, Inc.

2. Colors and Patterns: Refer to material finish / color schedule Section 000200.

B. Particleboard: ANSI A208.1, Grade M-2.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Type as detailed on drawings and described as follows:
   a. Type 1 - 1-1/2-inch (38-mm) laminated bullnose.
2. Backsplash: Straight, slightly eased at corner as indicated on drawings.
3. End Splash: Matching backsplash as indicated on drawings.

C. Countertops: 1/2-inch- (12.7-mm-) with front edge built up with same material.

D. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.

E. Joints: Fabricate countertops without joints.

2.3 WINDOWSILL FABRICATION

A. Fabricate windowsills according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration:

1. Front: Straight edge with eased corners,

C. Windowsills: 1/2-inch- (12.7-mm-).

D. Joints: Fabricate windowsills without joints.

2.4 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product certificates.

C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.
11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F (deg C).

E. Connector Type(s): Union joint, adjustable angle rigid, back and rigid, bottom, with unified-inch screw threads.

F. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.

H. Window: plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide by one of the following:

   a. Flo Fab Inc.
   b. Miljoco Corporation.
   c. Palmer Wahl Instrumentation Group.
   d. Tel-Tru Manufacturing Company.
   e. Trerice, H. O. Co.
   f. Weiss Instruments, Inc.
   g. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: plastic.
8. Stem: Aluminum and of length to suit installation.

   a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide by one of the following:

    a. Ernst Flow Industries.
    b. Marsh Bellofram.
    c. Miljoco Corporation.
    d. Palmer Wahl Instrumentation Group.
    e. REOTEMP Instrument Corporation.
    f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    g. Weiss Instruments, Inc.
    h. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.
3. Case: Plastic; 7-inch (178-mm) nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue[or red] organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: plastic.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide by one of the following:

a. AMETEK, Inc.; 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 Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: plastic.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide by one of the following:

a. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Flo Fab Inc.
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. Weiss Instruments, Inc.
l. WIKA Instrument Corporation - USA.

m. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: plastic.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

C. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide by one of the following:

a. AMETEK, Inc.; 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 Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: plastic.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

D. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide by one of the following:

a. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Miljoco Corporation.
d. Noshok.
e. Palmer Wahl Instrumentation Group.
f. REOTEMP Instrument Corporation.
g. Tel-Tru Manufacturing Company.
h. Trerice, H. O. Co.
i. Weiss Instruments, Inc.
j. WIKA Instrument Corporation - USA.
k. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch (114-mm) nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: plastic.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

K. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

B. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

C. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be[one of] the following:

1. Liquid-filled direct -mounted, metal case.
2. Sealed, direct -mounted, plastic case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be[one of] the following:

1. Liquid-filled direct -mounted, metal case.
2. Sealed, direct-mounted, plastic case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa).

B. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze globe valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.

4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Grooved: with grooves according to AWWA C606
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Kitz Corporation.

2. Description:

   a. Standard: MSS SP-110.
   b. CWP Rating: 400 psig.
   c. Body Design: One piece.
   d. Body Material: Forged brass.
   e. Ends: Threaded.
   f. Seats: PTFE or TFE.
   g. Stem: Brass.
   h. Ball: Chrome-plated brass.
   i. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Milwaukee Valve Company.
   b. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

C. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Hammond Valve.
b. Jamesbury; a subsidiary of Metso Automation.
c. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Regular.

2.3 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig (2760 kPa).

c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

C. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Milwaukee Valve Company.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.

i. Ball: Chrome-plated brass.
j. Port: Regular.

2.4 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Milwaukee Valve Company.
b. NIBCO INC.
c. Powell Valves.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject 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. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject 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 Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Division.
    e. Hammond Valve.
    f. Kitz Corporation.
    g. Milwaukee Valve Company.
    h. NIBCO INC.
    i. Powell Valves.
    j. Red-White Valve Corporation.
    k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    l. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 3.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.
    e. Kitz Corporation.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Red-White Valve Corporation.
    i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 4.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: PTFE or TFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject 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 Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Division.
    e. Kitz Corporation.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Red-White Valve Corporation.
    i. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 3.
    b. CWP Rating: 300 psig (2070 kPa).
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Hammond Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 4.
    b. CWP Rating: 300 psig (2070 kPa).
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: PTFE or TFE.

2.6 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded 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. Nordstrom Valves, Inc.

2. Description:

a. Standard: MSS SP-78, Type II.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged 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. Nordstrom Valves, Inc.

2. Description:

a. Standard: MSS SP-78, Type II.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded 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. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged 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. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

E. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded 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. Nordstrom Valves, Inc.

2. Description:

a. Standard: MSS SP-78, Type II.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

F. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged 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. Nordstrom Valves, Inc.

2. Description:

a. Standard: MSS SP-78, Type II.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

G. Class 250, Cylindrical, Lubricated Plug Valves with Threaded 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. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

H. Class 250, Cylindrical, Lubricated Plug Valves with Flanged 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. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.

a. Throttling Service: Globe or ball.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-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 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.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, brass with brass trim.

4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Gate Valves: Class 125, NRS.
6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron Gate Valves: Class 125, NRS.
3. Iron Globe Valves: Class 125.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes 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.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) 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 (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 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 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.

3.4 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 (40 mm).

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use 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 or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 8 (DN 100 to DN 200), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 8 (DN 20 to DN 200), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 8 (DN 100 to DN 200), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 8 (DN 100 to DN 200), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 8 (DN 25 to DN 200), from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 8 (DN 50 to DN 200) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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. 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 (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to [partially cover] [cover full] circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

2. Sanitary Waste, Vent and Storm Drainage Piping:

   a. Background Color: Green.
   b. Letter Color: White.

3. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Black.
   b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 2 inches (50 mm), round.
   b. Hot Water: 2 inches (50 mm), round.

2. Valve-Tag Color:

   a. Cold Water: Green.
   b. Hot Water: Natural.

3. Letter Color:

a. Cold Water: Black.
b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:

   a. Cellular glass.
   b. Flexible elastomeric.
   c. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied jackets.
9. Tapes.
10. Corner angles.

B. Related Sections include the following:

1. Division 23 Section "HVAC Insulation."

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cell-U-Foam Corporation; Ultra-CUF.
b. Pittsburgh Corning Corporation; Foamglas Super K.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000 Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Insulco, Division of MFS, Inc.; SmoothKote.
    b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-96.
    b. Foster Products Corporation, H. B. Fuller Company; 81-33.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

4. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

    a. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm), in a Leno weave, for equipment and pipe.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
    b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto PVC Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.10 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Seal jacket to roof flashing with flashing sealant.
4. Seal to roof flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" Firestopping and fire-resistive joint sealers.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) 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.

3.5 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) 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 (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) 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. Equipment and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

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. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot, Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Stormwater and Overflow: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

C. Roof Drain and Sanitary Vent and Overflow Drain Bodies: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

Note: Insulate the first 10 feet of plumbing vent below roof.

D. Exposed Sanitary Drains, Sanitary Vent, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

3.13 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.
2. PVC: 20 mils (0.5 mm) thick.
3. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

D. Piping, Exposed:

1. None.
2. PVC 20 mils (0.5 mm) thick.
3. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

END OF SECTION 220700

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service, fire-service mains or combined water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

E. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances:

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Anvil International, Inc.
2) Victaulic Company of America.

F. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG Class 150.

1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

G. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.2 JOINING MATERIALS

A. Refer to Division 22 Section "Common Work Results for Plumbing" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.3 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

a. Standard: AWWA C219.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. American AVK Co.; Valves & Fittings Div.
    b. American Cast Iron Pipe Co.; American Flow Control Div.
    c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. East Jordan Iron Works, Inc.
    f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    g. McWane, Inc.; Kennedy Valve Div.
    h. McWane, Inc.; M & H Valve Company Div.
    i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
    j. Mueller Co.; Water Products Div.
    k. NIBCO INC.
    l. U.S. Pipe and Foundry Company.

4. Nonrising-Stem, Metal-Seated Gate Valves:

    a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

        1) Standard: AWWA C500.
        2) Minimum Pressure Rating: 200 psig (1380 kPa).
        3) End Connections: Mechanical joint.
        4) Interior Coating: Complying with AWWA C550.

5. Nonrising-Stem, Resilient-Seated Gate Valves:

    a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

        1) Standard: AWWA C509.
        2) Minimum Pressure Rating: 200 psig (1380 kPa).
        3) End Connections: Mechanical joint.
        4) Interior Coating: Complying with AWWA C550.

6. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

    a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

        1) Standard: AWWA C509.
        2) Minimum Pressure Rating: 250 psig (1725 kPa).

3) End Connections: Push on or mechanical joint.
4) Interior Coating: Complying with AWWA C550.

7. OS&Y, Rising-Stem, Metal-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.

1) Standard: AWWA C500.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Flanged.

8. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. American Cast Iron Pipe Co.; American Flow Control Div.
b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; M & H Valve Company Div.
g. Mueller Co.; Water Products Div.
h. NIBCO INC.
i. U.S. Pipe and Foundry Company.

4. UL/FMG, Nonrising-Stem Gate Valves:

a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Flanged.

5. OS&Y, Rising-Stem Gate Valves:

a. Description: Iron body and bonnet and bronze seating material.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Flanged.

C. Bronze Gate Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.

4. OS&Y, Rising-Stem Gate Valves:

a. Description: Bronze body and bonnet and bronze stem.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Threaded.

5. Nonrising-Stem Gate Valves:

a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

1) Standard: MSS SP-80.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
b. East Jordan Iron Works, Inc.

c. Flowserve.
d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
e. McWane, Inc.; Kennedy Valve Div.
f. McWane, Inc.; M & H Valve Company Div.
g. Mueller Co.; Water Products Div.
h. U.S. Pipe and Foundry Company.

4. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, [metal] [resilient]-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 WATER METERS

A. Water meters will be furnished by utility company. This Contractor shall include all the cost associated with dealing with the utility company.

2.7 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Ames Fire & Waterworks; a division of Watts Regulator Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

4. Standard: ASSE 1013 or AWWA C511.
5. Operation: Continuous-pressure applications.
6. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
7. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
8. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
9. Configuration: Designed for horizontal, straight through flow.
10. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Regulator Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Watts Water Technologies, Inc.
    f. Zurn Plumbing Products Group; Wilkins Water Control Products Div.

4. Standard: ASSE 1015 or AWWA C510.
5. Operation: Continuous-pressure applications, unless otherwise indicated.
6. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
7. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
8. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
9. Configuration: Designed for horizontal, straight through flow.
10. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be soft copper tube, wrought-copper, solder-joint fittings; and brazed joints.

F. Underground water-service piping NPS 4 and NPS 6 (DN 100 and DN 150) shall be the following:

1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.

G. Underground Fire-Service-Main Piping NPS 4 to NPS 8 (DN 100 to DN 200) shall be any of the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
2. PE, Class 150, fire-service pipe; molded PE fittings; and heat-fusion joints.
3. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC Class 150 fabricated or molded fittings; and gasketed joints.

H. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 10 (DN 150 to DN 250) shall be any of the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Division 22 Section "Common Work Results for Plumbing" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G. Install PE pipe according to ASTM D 2774 and ASTM F 645.

H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

I. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration.

J. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

K. Sleeves are specified in Division 22 Section "Common Work Results for Plumbing."

L. Mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

M. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.6 JOINT CONSTRUCTION

A. See Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
4. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 Section "Common Work Results for Plumbing" for joining piping of dissimilar metals.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. MSS Valves: Install as component of connected piping system.

D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.9 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install displacement-type water meters, NPS 2 (DN 50) and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Water Meters: Install compound-type water meters, NPS 3 (DN 80) and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.10 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.11 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. See Division 22 Section "Common Work Results for Plumbing" for piping connections to valves and equipment.

C. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve.

D. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.12 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.13 IDENTIFICATION

A. Install continuous underground[detectable] warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 Section "Common Work Results for Plumbing" for identifying devices.

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

A. Related Section:

1. None.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint 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) Elkhart Products Corporation; Industrial Division.
        2) NIBCO INC.
        3) Viega; Plumbing and Heating Systems.
        4) <Insert manufacturer's name>.

    b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

6. Copper Push-on-Joint 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) NVent LLC.

    b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Copper Pressure-Seal-Joint 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) Elkhart Products Corporation; Industrial Division.
        2) NIBCO INC.
        3) Viega; Plumbing and Heating Systems.

    b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    c. NPS 3 and NPS 4 (DN 80 and DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

C. CPVC Pipe: Plenum rated ASTM F 441/F 441 M, Schedule 40.

1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.

B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; 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 B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

C. CPVC Union 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. American Valve, Inc.
   b. Asahi/American, Inc.
   c. Colonial Engineering, Inc.
   d. Fischer, George, Inc.
   e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
   f. IPEX, Inc.
   g. NIBCO, Inc.
   h. Sloane, George Fischer, Inc.
   i. Spears Manufacturing Company.
   j. Thermoplastic Valves, Inc.

2. Description:

a. Standard: MSS SP-122.
b. Pressure Rating: 125 psig (860 kPa) at 73 deg F (23 deg C).
c. Body Material: CPVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket or threaded.
f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket or threaded.
g. Ball: CPVC; full port.
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Description:

a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig (1035 kPa).
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig (1035 kPa).
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Description:

a. Galvanized-steel coupling.
b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
c. End Connections: Female threaded.

d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

1. Description:

a. Electroplated steel nipple complying with ASTM F 1545.
b. Pressure Rating: [300 psig (2070 kPa) at 225 deg F (107 deg C)] <Insert pressure and temperature>.
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.6 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
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.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
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.

2.7 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.

E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.

G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.8 SLEEVES

A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.9 SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.

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: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.10 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

E. Install domestic water piping level without pitch and plumb.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. 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.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping adjacent to equipment and specialties to allow service and maintenance.

J. Install piping to permit valve servicing.

K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50) and smaller. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water PipingNPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

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, flange kits.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

B. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

C. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
3. 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 (DN 65) and larger.

3.9 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
5. Bare Piping in Equipment Rooms: One piece, stamped steel with set screw.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

C. Escutcheons for Existing Piping:

1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
2. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge and spring clips.
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish.
6. Bare Piping in Equipment Rooms: Split plate, stamped steel with set screw or spring clips.
7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

3.10 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.

F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.

I. Seal space outside of sleeves in concrete slabs and walls with grout.

J. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

K. Install sleeve materials according to the following applications:

1. Sleeves for Piping Passing through Gypsum-Board Partitions:

    a. Galvanized-steel sheet sleeves for pipes NPS 6 (DN 150) and larger.
    b. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.

2. Sleeves for Piping Passing through Exterior Concrete Walls:

    a. Steel pipe sleeves for pipes smaller than NPS 6 (DN 150).
    b. Cast-iron wall pipe sleeves for pipes NPS 6 (DN 150) and larger.
    c. Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.11 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.12 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.14 CLEANING

A. Clean and disinfect potable and 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 and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) 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 (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.15 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) or ASTM B 88, Type M (ASTM B 88M, Type C); copper pressure-seal-joint fittings; and pressure-sealed joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) or ASTM B 88, Type M (ASTM B 88M, Type C); copper push-on-joint fittings; and push-on joints.

D. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) or ASTM B 88, Type M (ASTM B 88M, Type C); copper pressure-seal-joint fittings; and pressure-sealed joints.

3.16 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Balancing valves.
   4. Temperature-actuated water mixing valves.
   5. Hose bibbs.
   6. Wally hydrants.
   7. Drain valves.
   8. Water hammer arresters.
   9. Trap-seal primer valves.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

   1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), 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, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. MIFAB, Inc.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Light Commercial Operation.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Honeywell Water Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: NPS 3/4 (DN 20).
5. Body: Bronze.
6. End Connections: Union, solder joint.
7. Finish: plated Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Div.
    c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
7. Configuration: Designed for horizontal, straight through vertical flow.
8. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Div.
    c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

D. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Div.
    c. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
4. Size: NPS 2 (DN 50) or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armstrong International, Inc.
   b. Conbraco Industries, Inc.
   c. Honeywell Water Controls.
   d. Powers; a Watts Industries Co.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Powers; a Watts Industries Co.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa).
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded[union] inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
9. Valve Finish: Rough bronze.
10. Piping Finish: Copper.
11. Cabinet: Factory-fabricated, stainless steel, for recessed surface mounting and with hinged, stainless-steel door.

2.5 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.6 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company.
b. MIFAB, Inc.
c. Zurn Plumbing Products Group; Light Commercial Operation.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig (860 kPa).
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 (DN 20 or DN 25).
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze chrome plated.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
   b. Watts Industries, Inc.; Water Products Div.
   c. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig (860 kPa).
6. Operation Loose key or wheel handle.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.9 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. MIFAB, Inc.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain

piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install water hammer arresters in water piping according to PDI-WH 201.

G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

H. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

I. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Intermediate atmospheric-vent backflow preventers.
2. Reduced-pressure-principle backflow preventers.
3. Double-check backflow-prevention assemblies.
4. Water pressure-reducing valves.
5. Primary, thermostatic, water mixing valves.
6. Supply-type, trap-seal primer valves.

J. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

B. See Division 22 Section "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.3 SUBMITTALS

A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.

B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

    a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
    b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
2. Pressure Fittings:

    a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
    b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
    c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
    d. Cast-Iron Flanges: ASME B16.1, Class 125.
    e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.

E. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40, solid wall.

1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
2. Solvent Cement and Adhesive Primer:

    a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
2. Solvent Cement and Adhesive Primer:

    a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings and sovent stack fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.
4. Copper DWV tube, copper drainage fittings, and soldered joints.

D. Aboveground, soil, waste, and vent piping [NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings and sovent stack fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.

E. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Underground, soil and waste Piping NPS 5 (DN 125) and larger shall be any of the following:

1. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

M. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.

3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

B. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes the following sanitary drainage piping specialties:
   1. Backwater valves.
   2. Cleanouts.
   3. Floor drains.
   4. Miscellaneous sanitary drainage piping specialties.
   5. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Drain-Outlet Backwater Valves:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
      c. Zurn Plumbing Products Group; Specification Drainage Operation.

   2. Size: Same as floor drain outlet.
   3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
   4. Check Valve: Removable ball float.
   5. Inlet: Threaded.
   6. Outlet: Threaded or spigot.

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk or raised-head, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Watts Drainage Products Inc.
    d. Zurn Plumbing Products Group; Light Commercial Operation.
    e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for adjustable housing heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Field condition.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with set-screws or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round nickel-bronze, wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Watts Drainage Products Inc.
    e. Zurn Plumbing Products Group; Light Commercial Operation.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3 with backwater valve.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top or Strainer Material: Nickel bronze.
10. Top of Body and Strainer Finish: Nickel bronze.
11. Top Shape: Round.
12. Dimensions of Top or Strainer: 5-inches.
13. Trap Pattern: Standard P-trap.
14. Trap Features: Trap-seal primer valve drain connection.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches (51 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) 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 (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.

J. Install deep-seal traps on floor drains and other waste outlets, if indicated.

K. 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.

L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N. Install vent caps on each vent pipe passing through roof.

O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 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 221413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following storm drainage piping inside the building.

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Roof sumps.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water (30 kPa).

1.3 SUBMITTALS

A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.

B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
2. Pressure Fittings:

a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
d. Cast-Iron Flanges: ASME B16.1, Class 125.
e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

E. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40, solid wall.

1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
2. Solvent Cement and Adhesive Primer:

a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
2. Solvent Cement and Adhesive Primer:

a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Roof Sumps:

1. Roof Drains: 100C4 bi-functional roof drain (Drawing Tag RS-1):

a. Compliance: ANSI/ASME A112.21.2M. and IAPMO IGC 187- 2003.

b. Body: Patented bi-functional body. Powder coated, ASTM A48, Class 25 cast iron body with anchor flange.
c. Dome Strainer: Cast Iron strainer: Min: Free area of 136 square inches.
d. Membrane Clamp Ring: 2.375-inch wide, ASTM A 48, Class 25 cast iron, waterproofing membrane clamp ring with integral gravel stop.
e. Pipe Size: 4 inches and 6 inches.

2. Roof Drain Options:

a. LP-Low profile roof drain 4" overflow height.
b. OFS-Overflow Strainer: Debris strainer for overflow pipe.
c. DEX-adjustable extension to adjust proper primary outlet elevations in relation to deck thickness and/or adjust drain inlet elevations in relation to insulation thickness.
d. FR-Finishing Ring; recessed ring to allow the drain body to be installed in flush configuration and/or to be used to install drain with extensions used to adjust for thicker deck sections.
e. DC-Deck Clamp; underdeck clamp (used to secure drain to deck). Exterior clamp.
f. IG- RMA Guard high type #304 stainless steel perforated gravel guard (attaches to drain ring to prevent ballast and debris from entering drain area when installed with IRMA roofing system.
g. DP-deck plate.
h. SP-1-1/2" deep sumped drain pan (needs to be field cut).
i. DMP-Deck mounting plate allows drain to be directing mounted to plate and eliminates need for deck clamp.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Aboveground storm and overflow drainage piping NPS 6 (DN 150) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and coupled joints.
3. Steel pipe, drainage fittings, and threaded joints.

C. Underground storm drainage piping NPS 6 (DN 150) and smaller shall be any of the following:

1. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

E. Install wall-penetration-fitting system at each service pipe penetration through foundation wall. Make installation watertight.

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

G. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Install ABS storm drainage piping according to ASTM D 2661.

L. Install PVC storm drainage piping according to ASTM D 2665.

M. Install underground ABS and PVC storm drainage piping according to ASTM D 2321.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

J. Install supports for vertical copper tubing every 10 feet (3 m).

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.6 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.
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 storm drainage piping according to procedures of authorities having jurisdiction.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Attention is directed to General Conditions, Supplementary Conditions and General Requirements which are hereby made a part of this Section.

B. All work performed under this Section of the work is subject to all requirements contained under Section 15010 “Mechanical General Requirements”.

1.2 DESCRIPTION:

A. General: Provide basic materials for mechanical work and install in accordance with the Contract Documents.

1.3 PRODUCT HANDLING:

A. Deliver materials to the job site in original containers and packages, bearing the manufacturer’s labels indicting name, type and brand.

1.4 CONTENTS:

A. Major items of work and equipment included under this Section of the Specifications are plumbing fixtures, materials and finish applications for a complete installation.

B. Described herein are the following:

Plumbing Fixtures and Accessories
Plumbing Fixture Connections
Plumbing Fixture Schedule
Equipment

1.5 SUBMITTALS:

A. Product Data:

1. Water closets, including carriers, seats and flush valves.
2. Lavatories, including carriers, faucets, stops, supplies, and drains and traps.
3. Lavatory hot water tempering supply fixture.
4. Electric water coolers, including carriers.
5. Service sinks, including supply fitting and drain.
6. Stainless steel sinks, including faucets, stops, supplies, drains and traps.
7. Showers, including mixing valves and showerheads.
8. Emergency eye wash fixtures.
9. Emergency shower fixtures.
10. Fixture sealant.

PART 2 - MATERIALS AND INSTALLATION

2.1 PLUMBING FIXTURES AND ACCESSORIES:

A. Provide and connect all fixtures shown on the Drawings or herein called for. All fixtures shall be equal in all respects to the figure numbers hereinafter listed. Figure numbers are used for establishing a standard. All fixture trim shall be by one manufacturer only. No mixing of trim or fixtures will be permitted unless otherwise specified.

B. Unless otherwise specified, all exposed fixture trimmings shall be first quality, chromium plated brass, including pipe nipples from points of rough-in in walls to fixture stops. All faucets shall have renewable seats and discs.

C. Lavatories shall be supported as specified on chair carriers or on concealed hangers attached to walls with through bolts. Where fixtures are opposite each other, the bolts shall pass through both hangers.

D. Fixtures and equipment shall be supported and fastened in a satisfactory manner. Where secured to concrete or brick walls, hangers shall be fastened with brass bolts or machine screws in lead-sleeve type anchorage units or with brass expansion bolts or machine screws in lead-sleeve type anchorage units. Wall hung water closets shall be supported on chair carriers.

E. This Contractor shall be responsible for protection against injury from building materials, acids, tools and equipment, all plumbing fixtures included in this Section of the Specifications. The cost of replacing and repairing plumbing fixtures made necessary by failure of this Contractor to provide suitable protection shall be paid for by this Contractor. After fixtures have been set, clean all fixtures.

F. Fixture connections shall be chrome plated flexible brass pipe. All water supply connections shall be provided with wheel handle stops or valves having NPT female inlets.

1. Approved Fixture Stop Manufacturers:

American Standard
Kohler
Chicago Faucet
T & S Brass & Bronze Works, Inc.

G. Physically handicapped fixtures shall be installed in strict accordance with the Department of Labor Construction Code Commission General Rules for the Physically Handicapped and A.D.A.

H. All chrome plated brushed satin finish shall conform to U.S. Bureau of Standards No. US 26D.

I. Install plumbing fixtures of types indicated where shown and at indicated heights in accordance with fixture manufacturer's written instructions roughing-in drawings and with recognized industry practices. Ensure that plumbing fixtures comply with requirements of local codes, the Michigan Plumbing Code and the National Standard Plumbing Code pertaining to installation of plumbing fixtures.

J. Joints between fixtures and wells or floors shall be filled with single-component silicone sealant complying with ASTM C920. Dow Corning, 786; GE Silicones Sanitary SCS 1700; Pecora, 898; or as approved. No Plaster of Paris shall be used.

2.2 PLUMBING FIXTURE CONNECTIONS:

A. Fixture connections shall be in accordance with the following table:

Fixture	Soil or Waste	Vent	Trap	Hot Water	Cold Water
Water Closets (Flush VA.)	4"	2"			1-1/4"
Lavatory	1-1/2"	1-1/2"	1-1/4"	1/2"	1/2"
Electric Water Coolers	1-1/2"	1-1/4"			1/2"
Service Sinks	3"	1-1/2"	3"	3/4"	3/4"
Sinks	1-1/2"	1-1/2"	1-1/2"	1/2"	1/2"
Wall Hydrants					3/4"
Hose Bibbs					1/2"

Others as indicated in the Contract Documents.

B. Fixtures shall be American Standard, Kohler or Crane. American Standard model numbers are used to establish a standard.

C. Fixture supports shall be Zurn. J.R. Smith, Josam or Wade.

D. Flush valve shall be Sloan or Zurn.

E. Toilet seats shall be open front Olsonite, Church, Centoco or Beneke.

F. Faucets shall be Symmons, Delta, Chicago or Speakman.

2.3 PLUMBING FIXTURE SCHEDULE:

P-1 Floor Mounted Water Closet (Physically Handicapped): American Standard 3043.102 "Madera", white vitreous china, siphon jet, elongated bowl with 1-1/2" top spud, bolts and bolt caps. Kohler "Highcliff" K-4368-ET or Eljer "Signature" 111-2145.

a. Flush Valve: Zoran Zems Hardwired with step down transformer quiet action flush valve with vacuum breaker, 1" screwdriver bak-chek angle stop and cap flush connection and coupling for 1-1/2" top spud, wall and spud flanges and adjustable tailpiece. Provide for each toilet room floor drain, a flush valve trap primer as manufactured by Precision Plumbing Products.

b. Seat: Olsonite 10ccss, white molded seamless open front and concealed self-sustaining check hinge.

c. Install fixture in accordance with Michigan Department of Labor Construction Code "Barrier Free" requirements and ADA requirements, mounting of flush valve to be with the lever on the wide side of the compartment.

P-2 Wall Hung Lavatories (Physically Handicapped): American Standard 0355.012 "New Lucerne" wall hung 20" x 18" size, vitreous china, lavatory wall mounted, front overflow, 4" high backsplash. Unit shall be drilled to receive the specified trim. Kohler "Kingston" K-2005 or Eljer "Signature" 051-3544.

a. Supports: Concealed arms and chair carrier.
b. Supplies: 1/2" x 3/8" angle supplies with wheel stops, flexible risers and CP escutcheon plates.
c. Trap: CP 1-1/4" cast brass adjustable "P" trap with cleanout and tubing outlet to wall complete with CP cast brass escutcheon with lock nut.
d. Trim: Deck mounted, vandal resistant, Kohler K7514 Insight faucet with 30 year Hybrid Energy System hardwired with step down transformer operated faucet with spout- mounted sensor, .5 GPM aerator, grid drain and 1-1/4" CP tailpiece. All exposed surfaces heavily chrome plate.
e. Install fixture in accordance with Michigan Department of Labor Construction Code "Barrier Free" requirements and ADA requirements.

P-3 Sink: Elkay Double Compartment "Lustertone" Model LR-3321, 33" x 21-1/2" overall size, each compartment 13-1/2" x 16" x 7-1/2" deep sink, sound deadened Type 302, 18-8 stainless steel, ledge back, Grip-Rim self-rimming feature. Unit punched to receive specified trim (3 holes).

a. Supplies: 1/2" x 3/8" angle supplies with wheel stops, flexible risers and CP escutcheon plates.
b. Kohler K15172-F Coralais, single control with sidespray or Elkay Model LK-2442 with two lever handles mixing faucet with swing spout and aerator. Exposed surfaces to be chrome plated.
c. Drain (right sink): LK-99 stainless steel.
d. Drain (left sink): Provide drain to accept garbage disposer. Disposer shall be similar to General Electric Model GFC 525F continuous feed type with manual test overload 1/2HP, 120V motor, plug and cord.
e. Trap: 1-1/2" CP cast brass with adjustable "P" trap with cleanout and tubing outlet to wall with CP cast brass escutcheon.
f. Approved Sink Manufacturers:

Elkay
Just

P-4 Sink: Elkay Double Compartment "Lustertone" Model DLR-3322-55, 33" x 21-1/2" overall size, each compartment 13-1/2" x 16" x 7-1/2" deep sink, sound deadened Type 302, 18-8 stainless steel, ledge back, Grip-Rim self-rimming feature. Unit punched to receive specified trim (3 holes).

a. Supplies: 1/2" x 3/8" angle supplies with wheel stops, flexible risers and CP escutcheon plates.
b. Kohler K15172-F Coralais, single control with sidespray or Elkay Model LK-2442 with two lever handles mixing faucet with swing spout and aerator. Exposed surfaces to be chrome plated.
c. Drain (right sink): LK-99 stainless steel.
d. Trap: 1-1/2" CP cast brass with adjustable "P" trap with cleanout and tubing outlet to wall with CP cast brass escutcheon.

e. All sink dimensions shall be confirmed with Architectural Base Cabinet Drawings to insure that top and sink compartments mate the companion base cabinet
f. Approved Sink Manufacturers:

Elkay
Just

P-5 Service Sinks: Powers-Fiat Model No. MSB-2424, one-piece, molded stone unit having 10" high walls with not less than 1" wide shoulders. Color shall be #231 white drift. Drain body shall be factory installed stainless steel #302 with combination dome strainer and lint basket. The drain body shall provide for a caulked joint to a 3" IPS silicone sealant shall be Plate #833-AA.

a. Supply Fitting: Vandal resistant Chicago Faucet No. 897, combination service sink fitting with vacuum breaker, 3/4" hose thread rigid spout, No. 369 lever handles, wall brace pail hook and No. "R" 1/2" flanged female adjustable arms with integral stops. All exposed surfaces shall be heavily chrome plated.
b. Rim Guard: Vinyl bumper guards equal to Plate #E-77-AA shall be provided on all sides not adjacent to wall.
c. Wall Guard: Stainless steel Model MSG2424.
d. Hose Bracket: Plate #832-AA, 18 gauge, No. 302 stainless steel hose bracket with rubber grip complete with 30" long flexible, cloth reinforced, 5/8" heavy duty rubber hose with 3/4" chrome coupling at hose end.
e. Approved Manufacturers:

Powers-Fiat
Stern-Williams
Mustee

P-6 Physically Handicapped Electric Water Cooler: Elkay No. EZ5TL8, two-level, barrier free unit with self-closing pressbar, and fully recessed refrigeration section. All stainless steel cabinet. Entire unit shall be lead free in Lead Contamination Control Act of 1988. Bowl shall be provided with bubbler with protective hood and stream regulator, receptor, and 1-1/4" waste line. Refrigeration system shall include a hermetically sealed compressor, and be 7.8 GPH at 90 degrees F. room temperature and 80 degrees F. inlet water temperature. Compressor shall be 1/5 HP, 120-1-60 with 3 foot long grounded power cord and plug. Provide five (5) year compressor warranty.

a. Supply: 1/2" x 3/8" angle supply with wheel stop, flexible supply and CP escutcheon.
b. Trap: 1-1/4" OD, CP brass with adjustable "P" trap, outlet tube to wall and CP escutcheon.
c. Approved Manufacturers:

Oasis
Elkay
Halsey Taylor
Sunroc
Haws

2.4 EQUIPMENT FURNISHED BY OWNER OR EQUIPMENT FURNISHED UNDER OTHER DIVISIONS OF THESE SPECIFICATIONS AND RELOCATED EQUIPMENT:

A. The Plumbing Contractor shall be responsible for roughing in all plumbing fixtures, equipment or devices requiring plumbing utilities. For new equipment, the Trade furnishing the equipment shall also furnish the Plumbing Contractor to complete his work. For existing equipment, roughing-in requirements shall be determined from actual field observations and measurements.

B. The Plumbing Contractor shall make all final plumbing connections to all new and existing equipment, fixtures or devices requiring plumbing utilities. Provide all necessary adapters, piping, shut-off valves, fixture stops, tailpieces, traps, backflow preventers and specialties for a complete and operable system conforming to state, local and applicable codes.

PART 3 - EXECUTION

3.1 GENERAL:

A. Rough-in and make final supply and waste tie-ins for plumbing fixtures.

B. Provide plumbing fixtures with shut-off stops as specified.

C. All exposed piping to plumbing fixtures: chromium-plated.

3.2 TRAPS AND CLEANOUTS:

A. Provide fixture traps of the water-seal, self cleaning “P” trap type. Trap water seal depth: not less than two inches and not more than four inches. Provide each trap with an accessible brass cleanout of ample size, protected by the water seal.

B. Provide nominal size of each fixture trap to be the same size as the fixture drain to which it is connected.

C. Provide running traps at locations indicated. Extend cleanouts for running traps, installed under the floor and not in trap pit, to finished floor.

3.3 TRANSFORMERS:

A. Provide 120V-24V transformers for all hard wired automatic valves and faucets. Coordinate number and location of transformers with Division 16 and requirement for outlet. Provide all 24V wiring downstream of transformer to fixtures in accordance with Division 16 requirements.

3.4 TRAP PRIMING:

A. Extend from each toilet room flush-valve trap primer, a ½-inch trap priming line to it’s corresponding toilet room floor drain priming connection.

3.5 SEALING:

A. Seal the space between plumbing fixtures (except slab top lavatories) and floors and walls.

B. Install sealant in accordance with manufacturer's recommendations, giving a neat, clean, stain-free finished job.

C. Seal self-rimming countertop sinks to countertops with sealant supplied with fixture.

3.6 FIXTURE PROTECTION:

A. Cover and protect the rims, fronts and exposed parts of lavatories, urinals, service sinks, water closets, drinking fountains and other plumbing fixtures with suitable guards and building paper, and maintain the protection until completion of work.

B. Install the above protection immediately at the time of setting the plumbing fixtures and remove only when directed by the Architect. Make any damage to fixtures good without additional cost to the Owner.

3.7 FIELD QUALITY CONTROL:

A. Verify that installed fixtures are categories and types specified for the locations installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures for proper operation after water systems are pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.8 ADJUSTING:

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.

B. Operate and adjust [garbage disposals] [point-of-use water heaters] [and] [controls]. Replace damaged and malfunctioning units [and controls].

C. Adjust water pressure at faucets, shower valves and flush valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

3.9 CLEANING:

A. Install and maintain pipe and equipment clean and free from rust, dirt and scale. Provide temporary covers at pipe and equipment openings.

B. Immediately before turning fixtures over to the Owner and as directed, remove temporary protection and provide final cleaning.

C. Remove faucet spouts, strainers and aerators, remove sediment and debris, and reinstall.

D. Remove sediment from drains and traps.

END OF SECTION 224000

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes 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.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:[Signed and sealed by a qualified professional engineer.] Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.3 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. 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.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. 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 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. 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.

3.2 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.

3.3 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 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.

3.4 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 (40 mm).

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use 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 or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. 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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

K. 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. 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 (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. 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.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Duct labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch (0.64-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Blue.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

2. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

J. Examine two and three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR 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. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.

7. Starter thermal-protection-element rating.

3.7 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

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 contractor.
3. Project name.

4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump 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. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

3.10 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber.

2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

B. Related Sections:

1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation, Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

2.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    b. Compac Corp.; 110 and 111.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) 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.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) 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 (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-(150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) 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 (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) 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.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.9 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.

4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed and Eexposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

B. Concealed and Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

C. Concealed and Exposed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

D. Concealed and exposed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

E. Concealed and Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

F. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

G. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

3.13 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm)] thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

B. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

C. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

D. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

E. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

F. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. Color-coded by system.
2. PVC: 20 mils (0.5 mm) thick.
3. Aluminum, Smooth 0.016 inch (0.41 mm) (1.0 mm)] thick.

D. Ducts and Plenums, Exposed:

1. Color coded by system.
2. PVC: 20 mils (0.5 mm) thick.
3. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. PVC, Color-Coded by System: 20 mils (0.5 mm) thick.
2. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

D. Ducts and Plenums, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):

1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.
2. Painted Aluminum, [Smooth] [Corrugated] [Stucco Embossed]: [0.016 inch (0.41 mm)] [0.020 inch (0.51 mm)] [0.024 inch (0.61 mm)] [0.032 inch (0.81 mm)] thick.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):

1. Painted Aluminum, Smooth with 1-1/4-Inch- (32-mm Deep Corrugations thick.

END OF SECTION 230700

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Attention is directed to General Conditions, Supplementary Conditions and General Requirements which are hereby made a part of this Section.

B. All work performed under this Section of the work is subject to all requirements contained under Section 15010, “Mechanical General Requirements”.

1.2 DESCRIPTION:

A. Furnish, install and wire all low voltage control devices and their related wiring. Low voltage is defined as any voltage system that is at or lower than the standard project 120 volt, single phase, 60 hertz system (excluding fire alarm, security and other communications type systems).

B. Furnish, install and wire electrical circuiting (120 volt) for control requirements from spare circuit breakers located in receptacle panels.

C. Furnish, install and wire 120 volt electric thermostats for mechanical equipment or systems.

D. Furnish, install and wire control relays and interlocks required between fans, pumps, dampers, smoke detectors and other mechanical equipment.

1.3 PRODUCT HANDLING:

A. Deliver materials to the job site in original containers and packages bearing the manufacturers labels indicating name, type and brand.

1.4 CONTENTS:

A. Major items of work and equipment included under this Section of the Specifications are materials, and finish applications for a complete installation.

1.5 WORK INCLUDED:

A. Provide satisfactory operation without damage at 110% above and 85% below rated voltage and at 3 hertz variation in line frequency. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be a/c. coupled, or equivalent so that any single device failure will not disrupt or halt bus communication.

PART 2 - MATERIALS, EQUIPMENT AND INSTALLATION

2.1 GENERAL INSTALLATION:

A. Electric controls shall be furnished and installed in accordance with the Control descriptions hereinafter specified, and shall perform the functions indicated. Installation and adjustment of controls shall be made by the manufacturer's representative.

B. Electric controls shall be as manufactured by Trend Control System, Johnson Service Company, Siemens Building or Honeywell and shall be equal to the controls listed on the Drawings and/or hereinafter specified.

C. Wiring required for the electrical controls shall be provided and installed by Control Trades unless otherwise indicated on the Drawings and shall be in accordance with NEC requirements and Division 26 of these Specifications.

D. Identification of each controller shall be by an engraved phenolic resin label which shall show control name, operating range, and function. Label shall be glued to the controller or adjacent wall or shall be attached to the controller by chain or attached to the control panel.

E. Installation, adjustment and calibration of all controls shall be under the direction of a qualified Engineer. All controls shall be adjusted and calibrated during the test specified hereinafter, in the presence of and under the direction of the System Testing and Balancing Trades, including factory calibrated controls.

F. Control Trades shall provide a copy of these control diagrams neatly framed in plastic containers. Diagrams shall be mounted where directed by Architect and a set shall be included in the Owner's operation and maintenance manual.

G. Shop drawings shall contain a written description of control operation.

2.2 MATERIALS AND EQUIPMENT:

A. Provide lockable clear plastic covers for all thermostats serving rooftop units, unit heater, and cabinet unit heaters, with remote mounted thermostats.

1.1 GAS DETECTION EQUIPMENT

A. Manufacturers:

1. B. W. Technologies.
2. CEA Instruments, Inc.
3. Ebtron, Inc.
4. Gems Sensors Inc.
5. Greystone Energy Systems Inc.
6. Honeywell International Inc.; Home & Building Control.
7. INTEC Controls, Inc.
8. I.T.M. Instruments Inc.
9. MSA Canada Inc.

10. QEL/Quatrosense Environmental Limited.
11. Sauter Controls Corporation.
12. Sensidyne, Inc.
13. TSI Incorporated.
14. Vaisala.
15. Vulcain Inc.

B. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F (0 to 40 deg C); with 2 factory-calibrated alarm levels at 50 and 100] ppm.

C. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output;, for wall mounting.

D. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

1.2 THERMOSTATS

A. Manufacturers:

1. Erie Controls.
2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
3. Heat-Timer Corporation.
4. Sauter Controls Corporation.
5. tekmar Control Systems, Inc.
6. Theben AG - Lumilite Control Technology, Inc.

B. Electric, solid-state, microcomputer-based room thermostat with remote sensor.

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on every day of week.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:

    a. Time of day.
    b. Actual room temperature.
    c. Programmed temperature.
    d. Programmed time.
    e. Duration of timed override.
    f. Day of week.
    g. System mode indications include "heating," "off," "fan auto," and "fan on."

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual on-off-auto.

E. Room Thermostat Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Exposed.
2. Set-Point Indication: Exposed.
3. Thermometer: Exposed.
4. Color: clear plastic.
5. Orientation: Vertical.

F. Room thermostat accessories include the following:

1. Insulating Bases: For thermostats located on exterior walls.
2. Thermostat Guards: Locking; heavy-duty, transparent plastic; mounted on separate base.
3. Adjusting Key: As required for calibration and cover screws.
4. Set-Point Adjustment: 1/2-inch- (13-mm-) diameter, adjustment knob.

G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

H. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

1.3 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
4. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturers:

a. Belimo Aircontrols (USA), Inc.

2. Dampers: Size for running torque calculated as follows:

a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.

3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
6. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
7. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
8. Run Time: 12 seconds open, 5 seconds closed.

1.4 DAMPERS

A. Manufacturers:

1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. TAMCO (T. A. Morrison & Co. Inc.).
4. United Enertech Corp.
5. Vent Products Company, Inc.

B. Dampers: AMCA-rated, parallel-blade design; 0.108-inch- (2.8-mm-) minimum thick, galvanized-steel or 0.125-inch- (3.2-mm-) minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- (1.6-mm-) thick galvanized steel with maximum blade width of 8 inches (200 mm) and length of 48 inches (1220 mm).

1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. (50 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (1000 Pa) when damper is held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

PART 2 - EXECUTION

2.1 INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

B. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

C. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

E. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

F. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

G. Install electronic and fiber-optic cables according to Division 26 Section "Communications Horizontal Cabling."

2.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 26 Section "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

2.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

2.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 230900

SECTION 230900 - AUTOMATIC CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. General:

1. This Section provides for the automatic control systems, complete with components and accessories necessary for automatic operation, completely installed, adjusted, fully tested and ready for full normal operation.
2. It is not the purpose of this Specification to include the details of construction methods, or a complete listing of the materials and equipment which will be required in the Work.
3. Provide DDC controllers, sensors, thermostats, humidistats, automatic water valves, automatic dampers and damper motors, pressure gages, thermometers, piping, control wiring as specified in this Section, control panels, and other auxiliaries and appurtenances hereinafter specified or necessary to obtain complete working control of ALL mechanical systems.
4. Provide for the entire control system to be installed, supervised and tested by personnel regularly employed by the automatic control systems manufacturer.
5. Provide controls that are electric, DDC electronic, or a combination system of components necessary to accomplish the automatic control requirements of the mechanical work.
6. Provide all electrical work and wiring required for the automatic control systems unless indicated otherwise. All work shall be in accordance with NEC requirements and Division 25 of these specifications.
7. Provide required interfaces to packaged control equipment specified in these specifications.

    a. This section also provides for the furnishing of wiring and installation of field mounted devices provided with packaged HVAC equipment such as roof top units, package boiler, etc.

B. Products furnished but not installed under this Section:

1. Automatic control dampers.
2. Automatic valves.

1.2 REFERENCES:

A. American Society of Mechanical Engineers (ASME):

1. B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

B. American Society for Testing and Materials (ASTM):

1. B32 – Specification for Solder Metal.
2. B88 – Specification for Seamless Copper Water Tube.
3. D1693 – Test Method for Environmental Stress-Cracking of Ethylene Plastics.

C. National Fire Protection Association (NFPA):

1. 70 – National Electrical Code.
2. 90A – Installation of Air Conditioning and Ventilating Systems.

D. Underwriters Laboratories Inc. (UL):

1. 555 – Fire Dampers.
2. 555S – Leakage Rated Dampers for Use in Smoke Control Systems.
3. 864 – Control units for fire-protective signaling systems.

1.3 SYSTEMS DESCRIPTION:

A. The mechanical systems controlled include but are not limited to:

1. Air handling systems.
2. Ventilation systems.
3. Heating hot water systems.
4. Unit heater control.
5. Air terminal unit control.

B. Typical diagrams of automatic control systems and description of sequence of operation of systems are shown on the Drawings or included in the equipment Specifications.

1.4 SUBMITTALS:

A. General:

1. Include with submittals, system piping and electrical connections and a written description of operation. Include with equipment submittals, equipment used including flow measuring devices and dampers.
2. Submit engineering data for automatic control dampers that states the amount of leakage, flow characteristics and construction of dampers. Parallel dampers: linear flow characteristics. Opposed blade dampers: equal percentage flow characteristics.
3. Furnish graphic flow diagram drawings for each system
4. Label items and devices shown and indicate the following information:

a. Coordination with submitted catalog information.
b. Proper settings and adjustments of instruments.
c. Normal condition of devices, such as normally closed dampers, normally open valves and contacts.
d. Sizes of devices and accessories included with devices.

B. System Sequences:

1. Provide the control diagram for each system with a complete written sequence of operation pertaining to the diagram and shown on the same Drawing.
2. Write sequence in similar steps to the Specifications and as shown on the temperature control sheets.
3. Incorporate symbol elements from diagrams into the sequence, such as T-1 space thermostat.

C. Catalog Information:

1. Provide control diagram submittals with catalog sheets for every item used in the system.
2. Mark catalog sheets showing two or more devices or models of a device to show the specific model and/or accessories being used in the control diagram.
3. Refer to Section 220000 – Mechanical General Requirements.

D. Certification:

1. Include in certification listings of personnel, dates, and times of supervision, and attest that the level of supervision provided is sufficient to accomplish a quality and well integrated installation.
2. Submit certification that the automatic control system provider has supervised the installation of the control systems.
3. Submit certification that the automatic control system provider has supervised the installation of the interconnection of the control system with all other building and system controls or construction, and attests that such construction is in full compliance with the control system performance requirements.

1.5 QUALITY ASSURANCE:

A. Safety Devices:

1. Ensure that all safety devices, such as: freeze protection thermostats, smoke detectors, limit switches, overloads, remain active under all operating conditions.

B. Hazardous Areas:

1. Ensure that all wiring, conduit, starters, push buttons, control devices and other electrical devices provided for any areas which are indicated as hazardous or in areas classified as hazardous by The National Electrical Code, The American Insurance Association, or The National Fire Protection Association meet all requirements for these classifications.

1.6 WARRANTY:

A. Provide a two-year warranty for all automatic control system components. Refer to Section 220000 for additional requirements.

PART 2 - PRODUCTS

2.1 CONTROLS SUPPLIERS AND INSTALLERS:

A. Honeywell, Metro Control, Johnson Control, Mando Enviromental Control or as approved equal.

B. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not to be the products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number on a nameplate securely attached in a conspicuous place.

2.2 MATERIALS:

A. Electrical Components:

1. For material specifications of electrical components such as conduit, wire, relays, etc., refer to Division 26 Specifications.

2.3 GENERAL:

A. The Microprocessor based controllers shall monitor the data environment and perform control functions in relation to a programmed strategy and the status of the environment.

B. The system shall use solid state computer based digital and analog technology. The system shall be standard with the manufacturer to insure ongoing parts availability and trained technical support.

C. The Microprocessor controller shall be of the fully user programmable type requiring no special computer education for operation. All end user training shall be by the factory trained reseller.

D. The system shall be capable of stand alone operation without the presence of an operator or an on-site user interface computer.

E. Provide the hardware complete with all relays, digital to analog convertors, analog to digital covertors, and terminal strips factory wired. Protect controllers from memory loss for at least 72 hours upon power failure.

F. Provide controller software that includes a complete operating system, standard control algorithm application packages to produce the sequences shown on the drawings, and a user custom control and calculation application package. Provide complete user documentation.

G. Provide the operating system software prom resident. Provide the operating system to control communications between the system controller, the I/O modules and the operator's terminal. Provide system to accept true analog and digital inputs, produce true analog and digital outputs, provide alarm monitoring and control application programs, interface a variety of sensor and actuator types, and contain built-in diagnostic routines.

H. Provide all modulating control capable of (P, PI, or PID) control. In addition, adaptive control (self learning) algorithms shall be used on control loops where the controlled medium flow rate is variable.

2.6 SYSTEM CONTROLLERS (SC's)

A. Description: System Controllers (SC's) shall be provided capable of fully controlling main plant equipment, supervising Terminal Controllers (TEC's), and providing management capabilities. The SC's should comprise a single device, capable of fully performing its specified functions without the need for add-on cards or modules. They shall be fully configurable. The SC's shall be based on multi-layer printed circuit boards in metal enclosures, with 16 bit microcontrollers, battery-backed calendar clock chips, two communications ports, on-board RS-232 and RS-485, a minimum scan time of 1 second and a minimum communication speed of 9600 baud.

B. Firmware: Object oriented firmware shall be embedded in each SC so that linking pre-defined objects can configure specific sequences. No special programming language shall be necessary to fully configure SC's. Objects shall include Inputs, Binary Outputs, Schedule, Control State, Afterhours, Optimum Start, Demand Manager, Clock, Poll List, Alarm, Analog Outputs, Utility (for Setpoints, etc), Poll Manager, PID Loops, Broadcast, Logic, Timers, Calculated Points, Trend, Display Manager/List, Counters, Static Trend, Event Manager, Event Log, Function, Sequence, Monitor, Dial Manager, Encode, Calendar, Notify, and Notify Log. The ability to allocate multiple instances of control objects shall be provided. Each controller shall contain all available objects that may be used as required limited only by the maximum memory of the controller. All configurations shall be retained indefinitely through power outages in non-volatile memory.

C. Controllers: SC's shall perform Direct Digital Control (DDC) and energy management functions, control peripheral devices, and coordinate communications to other SC and TEC's in the network. SC's shall be capable of monitoring and organizing alarm and event information from other SC's and TEC's on the local bus.
Each SC shall have onboard I/O consisting of 16 Universal Inputs, 12 Normally Open Relay Outputs and 8 Analog Outputs, 0-10 Vdc.
The universal inputs shall have the pre-defined ability to interpret up to 4 contact closures in conjunction with a resistor ladder to any single input. They shall also read 0-5 Vdc and 4-20 ma Inputs as standard and have built-in Look-up tables for 3 kohm and 10 kohm thermistors. Inputs may be used for temperature, pressure, flow, current, frequency, and pulse counting.

Relay Outputs may be configured for maintaining momentary or pulse width modulated operation, with or without interlocks and with or without verification status of the controller device. Relay Outputs shall be rated at 2 amps at 24Vac.
Onboard LED's shall indicate the status of each Binary Output and the status of the communication busses. Four additional onboard LED's shall be available on each SC for custom user configuration.

The SC shall contain control programs in non-volatile memory. Each SC shall have the intelligence to perform all control strategies, without communication to other controllers. Each SC shall be able to share global values, such as electrical demand level between controllers on the same communication bus.

SC's shall support multi-user communications from the user interface computer and/or locally connected laptop service tools. They shall support modem dial-out and user dial-in. They shall be capable of sending different events and alarms to different locations and types of receiving devices including personal computers, pagers and printers.

D. Communication Ports: SC's shall provide concurrent communication to both the system bus and the local bus. In addition, a minimum of one RS-232 or RS-485 port shall be provided for connection to a user interface computer or a laptop computer. When the port is RS-232, it shall optionally support communication to a modem.

E. SC Firmware: The SC's shall contain pre-programmed firmware modules for the creation of standard applications. Modules will include as a minimum PID, schedules, calendar functions (seconds, minutes, hour, day of week, day of month, day of year, month, and year), logic, timers and optimum start. Each controller shall be capable of performing basic mathematical calculations (+, -, X. /). The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, greater than, lesser than, signed and unsigned, etc.

F. SC Trending: Each controller shall be capable of trending any system variable over user defined time intervals ranging from one second to four hours. Any system variable (inputs, outputs, math calculations, flags, etc.) can be trended. A maximum of 256 bytes or 128 words values can be stored in each trend in the SC. Trends can be concatenated. Trends may be manual or rotating. Trends may be uploaded to the user interface computer for display or storage on the hard disk.

G. SC Alarming: For each system point, alarms can be created based on high/low limits, high/low fault limits, change of value, change of state, or fault conditions. An adjustable time delay shall be included to prevent nuisance alarms. All alarms will be tested each scan and can result in the generation of one or more alarm messages. Messages and reports can be sent to the network computer running Alarm Monitor software, or via modem to a remote computing device.

H. Real-Time Clock (RTC): A battery backed uninterruptible Real Time Clock shall provide the following information: time of day, day, month, year, and day of week. In normal operation, the system clock will be based on the frequency of the AC power. The system shall automatically correct for daylight savings time and leap years.

2.7 INPUTS (SC's)

A. Inputs: The input section of System Controllers shall provide "universal" inputs capable of accepting information on any point in the form of a temperature, voltage, digital, or pulse counter with only a programming command required for differentiation between the input type. No hardware changes shall be required, other than changing pull-up or pull-down resistors.

B. Analog Inputs: The Analog Input (AI) function shall monitor each analog input, perform A/D conversion, and hold the digital value in a buffer for interrogation. The A/D conversion shall have a minimum resolution of 10 bits. Input ranges shall be within the range of 0-5 Vdc or 4 to 20 mA .

C. Digital Inputs: The digital input (DI) function shall accept normally open and normally closed dry contact closures only.

D. Pulse Accumulator Inputs: The pulse accumulator input function shall have the same characteristics as the DI, except that in addition a buffer shall be included to totalize pulses between interrogations. Each input shall accept pulses at up to 10 Hz.

E. Temperature Inputs: Temperature inputs originating from a 3 kohm or 10 kohm type 2 thermistor shall be monitored and buffered as an AI and provide automatic conversion to degrees Fahrenheit or Centigrade without any additional signal conditioning.

F. Input Wiring: All inputs shall be two-wire devices and shall not require additional wiring for unoccupied override pushbuttons.

2.8 OUTPUTS (SC's)

A. Output types shall include digital, tri-state, pulse width modulation, and analog.

B. Digital Output: The Digital Output (DO) function shall provide contact closure operation of field devices using maintained, verified, duty-cycled, or pulse on/off pairs. Contact rating shall be a minimum of 2 amps at 24 VAC. An on-board LED shall be provided to indicate the state of each digital output.

C. Tri-State Outputs: Tri-state outputs shall consist of two 24 Vac relays for control of bi-directional motors and actuators to a resolution of 1 second. Each tri-state output pair is capable of time base or feedback control.

D. Pulse Width Modulation Outputs: Output pulse width base time shall be selectable between 1 and a minimum of 255 seconds with a minimum output resolution of 0.1 seconds.

E. Analog Outputs: Analog outputs shall be suitable for up to 5 mA over 0-10 volts DC referenced to ground.

F. Power Supply: SC's will operate from 24 Vac 60/50 Hz power with a tolerance of +/- 15%. The controller shall contain over voltage surge protection and require no special AC power signal conditioning.

G. Automatic Restart after Power Failure: Upon restoration of power, the SC shall automatically and without human intervention: update all monitored functions, resume operation based on current synchronized time and status, and implement special startup strategies as required.

H. Indicator Lamps: System Controllers will have as a minimum LED indication of the system and local bus communications, the status of the outputs, and four amber auxiliary LEDs for status indication.

2.9 TERMINAL EQUIPMENT CONTROLERS (TEC's)

A. Description: A TEC has its own on board CPU, RAM, and EPROM, laptop communication port, and network connection to the local communication bus. The TEC contains its own on board I/O for complete stand-alone operation. Controls manufacturer shall offer application specific TEC's for packaged heating and A/C and fan coils. TEC's shall be based upon multi-layer printed circuit boards with 8 bit microcontrollers, a RS-485 communications port and a minimum communications speed of 9600 baud.

All TEC's shall be pre-programmed with multiple, application specific terminal control routines (personalities). No batteries shall be required for TEC's.

B. Configuration: The TEC may be programmed from a laptop service tool.

C. Application Firmware: The custom application firmware shall reside in non-volatile EEPROM or flash memory.

D. Terminal Equipment Controllers: TEC's shall provide stand-alone control of HVAC and lighting control. Each controller shall have its own control programs and will continue to operate in the event of a failure to communicate with the rest of the system.

Control programs shall be stored in non-volatile EEPROM or flash. Each TEC shall have the intelligence to perform all control strategies, without communication to other controllers, for control functions not requiring data from other controllers. Each TEC shall be able to have its control programs edited and/or modified either locally or remotely.

E. Communication Ports: Terminal Equipment Controllers shall provide communication to the local bus. In addition, a RJ-45 port shall be provided for connection to a laptop service tool, through the wall sensor, to support local programming and parameter changes. It shall be possible from this port to access and program any controller on the local bus.

F. TEC Firmware: The TEC's shall contain pre-programmed firmware modules for standard terminal unit applications for VAV, Fan Coil, Heat Pump, or Packaged AC unit. The specific equipment control shall be selected by personality.

G. TEC Trends: Each TEC controller shall be capable of trending two variables at time intervals ranging from 15 minutes to 4 hours. A maximum of 96 byte values can be stored in each trend in the TEC. Trends may be uploaded to the user interface computer for display or storage on the hard disk.

H. TEC Alarms: Each TEC controller shall have predefined High and Low alarms for Zone Temperature, and other controller values. The alarm status shall be available for the polling system controller or user interface computer in a standard polling table.

2.10 INPUT/OUTPUT (TEC's)

A. Inputs: The input section of TEC's shall provide eight inputs capable of accepting information on any point in the form of a temperature, voltage or contact closure.
The A/D conversion shall have a minimum resolution of 10 bits. Input ranges shall be 0 to 5 Vdc.

B. Temperature Inputs: Temperature inputs originating from a thermistor shall be monitored and buffered as an AI and provide conversion to degrees Fahrenheit or Centigrade.

C. Wall Sensor: The controls vendor shall provide a standard thermistor wall sensor with optional afterhours pushbutton and variable user adjust that connects to the TEC by a factory provided 8 conductor sensor cable.

An optional digital display wall sensor may be provided for the Packaged AC and VAV controller that is powered from the controller through the standard sensor cable and allows display and change temperature setpoints in half degrees Fahrenheit or Centigrade.

D. Schedules: Each terminal controller shall have its own occupancy state schedule providing for Unoccupied, Occupied, Night Setback and Morning Warm-up/Cool-down periods. Separate Cooling and Heating setpoints shall be provided during Unoccupied, Occupied, and Night Setback periods. The Morning Warm-up/Cool-down period shall use Occupied Setpoints.

E. Relay Outputs: The packaged AC controller shall provide 8 relay output with a minimum contact rating of 2 amp at 24 Vac, normally open and normally closed contacts with isolated common return.

F. Triac Outputs: The VAV and other Terminal unit controls shall provide 8 triac outputs switching to common, with a minimum rating of 1amp at 24 Vac unless it has an integral damper actuator in which case it will have only 5.

2.11 OUTPUTS (TEC's)

A. Output types shall include digital and tri-state.

B. Digital Output: The Digital Output (DO) function shall provide pilot-duty maintained contact closure for operation of field devices. Contact rating shall be a minimum of 1amp at 24 Vac.

C. Tri-State Outputs: Tri-state outputs shall consist of two 24 Vac triacs for control of bi-directional motors and actuators.

D. Networking: Each TEC will be able to provide information as requested by SC's during each local bus scan.

E. Power Supply: Each terminal controller shall have a built in power supply operating at 24 Vac, 60/50 Hz power +/-15%.

F. Automatic Restart after Power Failure: Upon restoration of power, the TEC shall automatically and without human intervention: update all monitored functions, resume operation based on current synchronized time and status, and implement special startup strategies as required.

G. Indicator Lamps: TEC will have LED indication of power and communication on the local bus.

H. Packaging: TEC's shall be housed in a steel enclosure, or in a plastic enclosure with a rating UL-94-5V or UL-94-V-0 suitable for installation in return air plenums, or within the rooftop units provided suitable locations are available.

2.12 POWER LINE SURGE PROTECTION:

A. Protect all equipment power supplies from power line surges. Provide protection near equipment in a separate metallic enclosure, if required, at ground potential and as necessary at the power panel to insure protection against surges. Provide functions of the program, software memory, etc., that are not affected by spikes, transients, etc.

2.13 SENSOR-TRANSMITTERS FOR DIRECT DIGITAL CONTROL (DDC):

A. General:

1. Provide the analog and digital sensor-transmitters required to meet the DDC system function requirements as shown on the control diagrams and input/output summary and specified herein.

B. Wells and Taps:

1. Wells required for immersion type temperature sensors are furnished under this Section and installed by Mechanical Trades.
2. Pressure sensing devices required are furnished under this Section of the Specifications and valved outlets off the piping provided by Mechanical Trades.

C. Sensor-Transmitters:

1. Room Temperature Sensors: The room sensor shall be a precision thermistor accurate within 0.36° over the range of the applications. The range shall be 55° to 95°. The sensor shall be securely mounted into a molded plastic cover for wall mount and include a digital temperature display and limited adjustment capabilities. The sensor shall be supplied with an RJ-45 modular connector at the back suitable for connecting pre-fabricated sensor cables, the other end of the sensor cables to plug into the controller in the associated rooftop A/C unit. Alternately the room sensor shall be wired from screw terminals to the controller. Provide an override and set point adjustment feature integral to the room sensors. Provide blank face sensors for rooms with monitoring only.
2. Duct Sensors: The duct sensor shall be a precision thermistor accurate to within 0.36° over the 45° to 160° range. The material shall be packaged in 4”, 8”, 12” or 16” long stainless steel tubes attached to a standard four-inch (4") electrical box.
3. Outside Air Sensor: The outside air sensor shall be a precision thermistor accurate to within 0.36° over the –30 to 180 deg F range. The active temperature sensitive element shall be sealed for moisture resistance. The sun shield shall be mounted on a weatherproof outlet box for installation on an outside surface. The outside assembly shall be located on the north side of the building, away from all devices, such as exhaust fans, that would influence the measured temperature.
4. Water Sensors: Provide a 100 ohm, platinum temperature sensor-transmitters. Provide a 4 to 20 mA transmitter if required by the DDC. The temperature control manufacturer’s transmitters are acceptable provided they are compatible with the DDC. Range and accuracy 30 to 100 degrees F within plus or minus 0.75 degrees F; 100 to 250 degrees F within plus or minus 0.5 degrees F. Provide matched sensors for purposes of using differential temperatures for Btu calculations.

5. Humidity Transmitter: The humidity transmitter shall be a two-wire, 0-5 Vdc or 4 to 20 mA output type with an accuracy of +/- 3% RH of a 15% to 95% RH span. Operating temperature shall be 0° to 120° Fahrenheit.
6. Provide pressure sensor-transmitters to produce a 4 to 20 mA output signal.
7. Air flow and static pressure sensors shall be high accuracy type suitable for low velocities pressures to be encountered.
8. Water flow and pressure sensors shall be sealed capacitance type with three valve manifolds for calibration and maintenance.
9. Refer to other articles in this section for additional pressure sensor specifications.
10. Provide dew point sensor-transmitters where necessary to produce the level of control required. Provide a temperature sensor with the dew-point sensor transmitter for the RH calculation.
11. Acceptable Manufacturers:
    Minco, Hy-Cal, Johnson, ASI, General Eastern, Viasala, Honeywell, Modus, Setra, Dwyer, Siemens.

2.14 THERMOSTATS:

A. Space Thermostats:

1. Programmable thermostats by Honeywell as called out on the documents for all heat pumps.
2. Space thermostats: proportional acting through an approximate range of 16 to 27 degrees C (60 degrees to 80 degrees F) and internal stops for minimum and maximum settings. Adjustable throttling range from 1.1 to 5.6 degrees C (2 to 10 degrees F). Mount room thermostats 1200 mm (48 inches) above the floor.
3. In general, provide thermostats with satin chrome cover with scale opening and thermometer.
4. Provide guards for thermostats located in equipment rooms, storage rooms, maintenance rooms and public areas where thermostats are subject to tampering or damage.
5. Provide thermostats in public areas with satin chrome finish blank covers.

B. Line-Voltage Thermostats:

1. Line-voltage thermostats: minimum rating of 6 amperes at 120 volts, with concealed or key adjustment, and thermometer. Ratings shall be adequate for the applied load.

C. Aquastats:

1. Aquastats: Line-voltage, strap on type. Switch rating shall be adequate for the applied load. Minimum rating of 6 amperes.

D. Freeze Protection Thermostats:

1. Freeze protection thermostats: manual reset type with 6-metre (20-foot) element. Element shall control from the coldest 300-mm (12-inch) portion.

   NOTE: Larger ductwork may require multiple freezestats for proper coverage of duct cross-sectional area.

2.15 CURRENT SENSING DEVICES:

A. Provide current sensing devices to monitor the status of fans and pumps as follows:

1. Current Switch:

a. Provide self-powered, fully isolated, solid state relay current switch with sensor thru-hole to accommodate up to #2/0 THNN insulated wire and adjustable ranging to monitor continuous loads up to 200 amperes. Response time: No less than 300 milliseconds to 99 percent of full scale. Provide overrange protection. Provide up to 1 ampere continuous switching capability for ac circuits and up to 0.15 ampere switching capability for dc circuits.

2. Analog Current Sensor:

a. Monitor current flow, as indicated on the drawings, from a loop-powered, fully isolated (ISA type 2, class U) current sensor with a 4-20 mA output. Sensor thru-hole to accommodate up to #2/0 THHN insulated wire, available in ranges from 10 amperes to 200 amperes. Accuracy: plus or minus 0.5 percent of full scale. Linearity and repeatability: plus or minus 0.1 percent of full scale. Response time: no less than 300 milliseconds to 99 percent of full scale. Provide overrange protection.

3. Approved Manufacturers: Neilsen-Kuljian; Veries Industries.

2.16 CARBON DIOXIDE SENSORS:

A. Carbon dioxide sensing cell shall consist of a nondispersive infrared carbon dioxide gas cell. Output shall be linearized 4-20 mA for use with 24 VDC input. The unit shall be specifically designed for the wall or duct application specified. Duct aspiration boxes shall be by the manufacturer. Unit shall have span adjustment. The unit shall have no moving parts.

B. Minimum requirements:

1. Range: 0-2,000 ppm.
2. Accuracy: 3% of full scale.
3. Repeatability: 1% of full scale.
4. Power Consumption: less than 3 watts.
5. Zero Drift at Constant Temp: 100 ppm per 24 hrs (random not cumulative).

C. Unit shall not require calibration for a period of 1 year or more.

D. Approved Manufacturers:

1. Valtronics.
2. Viasala.
3. MSA.

2.17 AUTOMATIC CONTROL DAMPERS AND OPERATORS:

A. Dampers:

1. Furnish the automatic control dampers shown on the Drawings.
2. Furnish dampers parallel blade or opposed blade as required and/or indicated for the applicable operation, with bronze bushings and stops on all sides. Dampers to operate smoothly from fully closed to fully open and from fully open to fully closed at the command of the controller without sticking or binding.
3. Furnish rigid construction and neoprene blade and end seals to reduce leakage to approximately 13.5 m3/hr (8 cfm) at 249 Pa (1 inch w.g.) differential pressure at 91 N· m (75 in. lbs.) of torque per m2 (sq. ft.) of damper area. Construct damper blades of minimum 16 gage steel with a maximum width of 200 mm (8 inches).
4. Where extremely low leakage dampers are indicated, such as fan discharge shut-off, furnish Ruskin Model CD-50.

B. Electric Damper Operators:

1. Provide electric operators for all automatic control dampers as indicated on the Drawings.
2. Provide electric damper operators with synchronous motor that is safe against blocking and overload. Provide an integral spring so that the operator will return to a positive position on power failure. Provide an integral 120v to 24v transformer. Provide the control circuit to function on 24-volt 60 hertz electrical power and have a maximum 60-second stroke. Include a linkage for operating the damper with the operator and damper body. Provide damper operators that are capable of providing specified leakage rating. Operators used on terminal equipment (VAV boxes, etc) shall fail in place unless noted otherwise.

2.18 AUTOMATIC VALVES AND OPERATORS:

A. General:

1. Furnish all automatic valves shown on the Drawings.
2. Provide automatic valves to be normally open or closed as required. Utilize positive positioning relays for sequence operation. Unless otherwise noted, provide valves single seated with replaceable composition disc and seat ring, equal percentage high lift plug, stainless steel stem and spring loaded, self adjusting Teflon cone packing. Use combination equal percentage and linear plugs on steam service. Replaceable seat rings are not required for water service.
3. Valves 2-1/2 inches and larger shall have flanged connections. Valves 2 inches and smaller shall have screwed connections.

B. Water Valves:

1. Select water valves such that the head loss at maximum flow will not exceed 30 kPa (10 feet water gage) or the loss through the heat exchanger served, which ever is greater.
2. Provide water valves that are capable of closing off against the maximum shutoff differential head between the pumps and the return line.

3. Where butterfly valves are used, provide high performance, minimum ANSI Class 150, valves for bubble tight shut off and modulating service. Provide valves with one piece PTFE valve seat with back-up ring, full lug type design, drilled and tapped carbon steel body, stainless steel disk and stem, non corrosive for service as shown on Drawings, and be rated for ANSI Class VI shutoff to FCI 70-2 at full rated pressure.
4. Characterized ball valves may be used on terminal equipment in lieu of plug and cage valves.

C. Electric Valve Operators:

1. Provide electric valve operators with synchronous motor that is safe against blocking and overload. Provide an integral spring so that the operator will return to a positive position on power failure. Provide an integral 120V to 24V transformer. Provide the control circuit to function on 24-volt 60 hertz electrical power and have a maximum 60-second stroke. Include a linkage for operating the valve with the operator and valve body. Operators used on terminal equipment shall fail in place unless noted otherwise.

2.19 PRESSURE GAGES:

A. Mount pressure gages on pneumatic operated damper motors, valve actuators and other pneumatic control equipment. Provide gages that are 50-mm-diameter (2-inch-diameter), stem mounted, 0-207 kPa (0-30 psi) range.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Electrical Components:

1. For installation standards and procedures for electrical components, refer to Division 16 Specifications.

B. Control Wiring (48 volts or less):

1. Provide plenum rated cable in an enclosed raceway where the wiring is not readily accessible.
2. Provide plenum rated cable in an enclosed raceway or in communication trays when used in equipment rooms.
3. Plenum cable may be used above accessible ceilings where it is not subject to damage. Cable is to be run in a workmanlike manner parallel to building structure, properly supported to prevent sagging and damage from other trades.
4. Provide wiring in raceways inside insulated wall cavities.
5. Clearly identify control wiring run in raceways.
6. Do not run low voltage wiring within raceways or trays containing wiring at 120 volts or above.
7. Mount thermostats or room temperature sensors on outlet boxes unless shown otherwise. Provide insulated backing for sensor’s mounted on exterior walls.
8. Plenum cable used in open areas without ceilings is to be provided in cable trays or in an enclosed raceway unless otherwise noted. The cable is to be run adjacent to or above mechanical ductwork and hidden from view wherever possible. Sample cable runs must be approved prior to installation.

C. Control Power Wiring:

1. The controls contractor shall provide all power required for control devices from spare 120 V circuits designated in electrical panels. Provide all required wiring, transformers, relays and accessories. All 120 V wiring should comply with Division 25. Whenever control power wiring is taken from a receptacle panel, provide a breaker handle locking device to lock the breaker in the "ON" position. Label circuit as "Control System Power, Do Not De-Activate".
2. Do not obtain control power from lighting panels.

D. Dampers:

1. The installation of automatic and smoke control dampers as specified in Section 233600.

E. Automatic Valves:

1. The installation of automatic valves is specified in Section 220010.

3.2 FIELD QUALITY CONTROL:

A. Function Test:

1. Test and adjust control equipment in terms of design, function and performance, ready for the required acceptance tests. Control devices and operators shall operate smoothly and freely without cycling or hunting.
2. Two weeks after acceptance and after the systems have operated in normal service, return to the site and check the adjustments on instruments and devices and correct items malfunctioning, at no expense to the Owner.

B. Acceptance Tests:

1. Upon completion of the testing of the air and hydronic systems, adjust the various control systems to function satisfactorily in compliance with the requirements of the Specifications and as shown.
2. Supply instruments required to conduct the control air testing and balancing operations.
3. Remedy any defects or malfunctions that are determined by these tests and repeat tests until defects have been corrected to the complete satisfaction of the Architect.

C. Adjusting and Balancing:

1. Cooperate with and assist the adjusting and balancing personnel in their adjusting and balancing of the air and hydronic systems.

3.3 DEMONSTRATION:

A. Operating and Service Instructions:

1. Furnish the Owner with two copies of complete operating and service instructions, covering control equipment and its relationship to, and interlock with, heating ventilating and air conditioning equipment.
2. Furnish the service of a fully competent operational instructor for three eight-hour days training sessions on systems operation, maintenance, repair and adjustment and two eight-hour days training sessions on system software and user changeable software. In addition, the Owner shall schedule during the first year of operation, two additional eight-hour days training sessions which shall consist of a user-defined combination of the above listed topics. An eight-hour day shall consist of eight hours of instructions, exclusive of travel time.
3. Furnish the Owner with a recommended list of required spare parts to be stocked on site.
4. Minimize requirements for special tools. When special tools are required or called for to be provided for the operating and adjustment of controllers, instruments and dampers, furnish them, including necessary duplicates required for normal use.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.3 SEQUENCE OF OPERATION:

A. Refer to drawings for sequence of operation.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 231123 - NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide piping, fittings, and specialties for Natural Gas Systems

B. The support spacing for the black steel gas piping must be in accordance with Table 415.1 of the Fuel Gas Code. (*IFGC Table 415.1*)

1.2 WORK BY OTHERS - UTILITY COMPANY:

A. Gas meter, pressure regulator and related valves will be furnished and installed by Consumer's Energy.

B. All gas piping outside the building, upstream of the gas meter is provided by Consumer's Energy.

C. Contractor shall coordinate installation of meter and related components with Consumer's Energy and owner.

D. Expenses and fees for Consumer's Energy work shall be paid for by the owner.

1.3 QUALITY ASSURANCE:

A. Comply with the requirements of NFPA 54 - National Fuel Gas Code, for gas piping materials and components, and gas piping systems installation, inspection, testing, and purging.

PART 2 - PRODUCTS

2.1 GAS LINE PRESSURE REGULATORS:

A. Single stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 2 inch and smaller, flanged ends for 2-1/2 inch and larger; for inlet and outlet gas pressures, specific gravity, and volume flow indicated.

B. Manufacturers: Maxon

2.2 LUBRICATED PLUG VALVES:

A. Gas Cocks 2 Inch and Smaller: 150 psi WOG, bronze body, straight-away pattern, square head, threaded ends.

B. Gas Cocks 2-1/2 Inch and Larger: MSS SP-78; 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.

C. Manufacturers: Jenkins Bros., Lunkenheimer Co., NIBCO, Inc., Powell Co., Stockham

PART 3 - EXECUTION

3.1 PREPARATION:

A. Precautions: Before turning off gas, turn off all equipment valves. Perform a leakage test to determine that all equipment is turned off.

3.2 HANDLING FLAMMABLE LIQUIDS:

A. Remove and legally dispose of liquid from drips in existing gas piping. Handle cautiously to avoid spillage or ignition.

3.3 NATURAL GAS PIPING INSTALLATION REQUIREMENTS:

A. See Section 220010 for piping materials and installation requirements.

B. Install, inspect, test, and purge natural gas systems in accordance with NFPA 54, and local utility requirements.

C. See Section 220560 for valve installation requirements.

D. Gas piping in air plenum ceilings shall be continuously welded or installed in air-tight conduit constructed of Schedule 40 seamless black steel pipe with welded joints. Vent conduit to the outside and terminate with a screened vent cap. Valves shall not be installed in plenums.

E. Drips and Sediment Traps: Install a drip leg at inlet to terminal equipment, points where condensate may collect, and at the outlet of the gas meter. Do not install drips where condensate is likely to freeze. Construct drips using a tee with plugged or capped bottom outlet. Drip shall be minimum of 3 pipe diameters long, same size as pipe. Locate drips to permit cleaning and emptying.

3.4 GAS LINE PRESSURE REGULATOR INSTALLATION:

A. Install a gas isolation valve upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a valve is not required at the second regulator.

B. Install pressure relief or pressure limiting devices so they can be readily operated to determine if the valve is free; so they can be tested to determine the pressure at which they will operate; and examined for leakage when in the closed position.

C. Install vent line from pressure regulators to outdoors.

3.5 ELECTRICAL BONDING AND GROUNDING:

A. Install above ground portions of gas piping systems, upstream from equipment shutoff valves electrically continuous and bonded to a grounding electrode in accordance with NFPA 70 - "National Electrical Code."

B. Do not use gas piping as a grounding electrode.

C. Conform to NFPA 70 - "National Electrical Code," for electrical connections between wiring and electrically operated control devices.

3.6 GAS LINE PAINTING:

A. All exterior gas lines shall be painted in accordance with painting section specification.

END OF SECTION 231123

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

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 of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) 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."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," 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."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "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."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, 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. McGill AirFlow LLC.
    b. SEMCO Incorporated.
    c. Sheet Metal Connectors, Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation> or comparable product by one of the following:

a. Johns Manville.
b. Knauf Insulation.

c. Owens Corning.

3. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.

4. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
5. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).
7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

a. Fan discharges.
b. Intervals of lined duct preceding unlined duct.
c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: [3 inches (76 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. 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 (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

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 the 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 according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "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 Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
3. Test for leaks before applying external insulation.
4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
5. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "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 fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

1. Ducts Connected to Constant-Volume Air-Handling Units:

    a. Pressure Class: Positive 3-inch wg (750 Pa).
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive [3-inch wg (750 Pa).
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

B. Return Ducts:

1. Ducts Connected to Air-Handling Units:

    a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
b. Concealed: Carbon-steel sheet.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: 3.

4. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg (500 Pa).
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

5. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

E. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1-1/2 inches (38 mm) thick.
2. Return Air Ducts: Fibrous glass, Type I, 1-1/2 inches (38 mm) thick.

3. Supply Fan Plenums: Fibrous glass, Type II, 1-1/2 inches (38 mm) thick.
4. Return-Fan Plenums: Fibrous glass, Type II, 2 inches (51 mm) thick.
5. Transfer Ducts: Fibrous glass, Type I, 1-1/2 inches (38 mm) thick.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "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 2-3, "Vanes and Vane Runners," and Figure 2-4, "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 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "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 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "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, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "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 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Combination fire and smoke dampers.
e. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
f. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.2 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

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 (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

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. Greenheck Fan Corporation.
2. Or approved equal by the school district

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm (10 m/s).

D. Maximum System Pressure: 1-inch wg (0.25 kPa).

E. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch (150-mm) width, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:

1. Material: Galvanized steel.
2. Diameter: 0.20 inch (5 mm).

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.

5. Screen Mounting: Front mounted in sleeve.

a. Sleeve Thickness: 20-gage (1.0-mm) minimum.
b. Sleeve Length: 6 inches (152 mm) minimum.

6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel
8. Screen Type: Insect.
9. 90-degree stops.

2.3 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. Flexmaster U.S.A., Inc.
b. Nailor Industries Inc.
c. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
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, 0.064 inch (1.62 mm) thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

a. Molded synthetic.
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch (25-mm) 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- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

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. Greenheck Fan Corporation.
2. Or approved equal by the school district.

B. Frames:

1. Hat shaped.
2. Galvanized-steel channels, 0.064 inch (1.62 mm) thick.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 8 inches (200 mm).
2. Parallel- and opposed-blade design.
3. Galvanized steel.
4. 0.064 inch (1.62 mm) thick.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

E. Bearings:

1. Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.5 FIRE DAMPERS

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. Greenheck Fan Corporation.
2. Or approved equal by the school district.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

K. Heat-Responsive Device: Electric resettable link and switch package, factory installed, 165 deg F (74 deg C) rated.

2.6 SMOKE DAMPERS

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. Greenheck Fan Corporation.
2. Or as approved equal by the school district.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Coordinate with fire alarm requirement.

D. Frame: fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

F. Leakage: Class I or Class II.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

I. Damper Motors: two-position action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

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. Controllers, Pneumatic Devices, Electrical Devices, Piping, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC.".
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).

K. Accessories:

1. Auxiliary switches for signaling.
2. Test and reset switches mounted.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

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. Greenheck Fan Corporation.
2. Or as approved equal by The School District.

B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.

D. Fire Rating: 1-1/2 or 3 hours.

E. Frame: Curtain type with blades inside airstream Multiple-blade type or Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

H. Smoke Detector: Integral, factory wired for single-point connection.

I. Frame: Curtain type with blades inside airstream or Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

J. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

K. Leakage: Class I or Class II.

L. Rated pressure and velocity to exceed design airflow conditions.

M. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

N. Master control panel for use in dynamic smoke-management systems.

O. Damper Motors: two-position action.

P. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in [Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
7. Electrical Connection: 115 V, single phase, 60 Hz.

Q. Accessories:

1. Auxiliary switches for signaling or position indication.
2. Momentary test switch remote mounted.

2.8 CORRIDOR DAMPERS

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. Ruskin Company.
2. Or as approved equal by The School District.

B. General Requirements: Label combination fire and smoke dampers according to UL 555 for 1-1/2-hour rating by an NRTL.

C. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

D. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

E. Frame: Curtain type with blades inside airstream or Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

G. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application.

H. Damper Motors: two-position action.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in [Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.

3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
7. Electrical Connection: 115 V, single phase, 60 Hz.

2.9 REMOTE DAMPER OPERATORS

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. Pottorff; a division of PCI Industries, Inc.
2. Ventfabrics, Inc.
3. 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, 3/4 inches (19 mm) deep.

F. Wall-Box Cover-Plate Material: Steel.

2.10 FLANGE 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. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division Insert manufacturer's name>.

B. Description: roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.11 TURNING VANES

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. SEMCO Incorporated.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

F. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.12 DUCT-MOUNTED ACCESS DOORS

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. Greenheck Fan Corporation
2. Or approved equal by the school district.
3. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

4. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

5. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
6. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

B. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 10-inch wg (2500 Pa).
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.13 DUCT ACCESS PANEL ASSEMBLIES

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. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch (1.3-mm) carbon steel.

D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).

F. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

2.14 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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
2. Minimum Tensile Strength: 500 lbf/inch (88 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

2.15 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).

C. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.

1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).

D. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.

2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).

E. Noninsulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).

F. Noninsulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.

1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
2. Maximum Air Velocity: 5000 fpm (25 m/s).
3. Temperature Range: Minus 100 to plus 435 deg F (Minus 73 to plus 224 deg C).

G. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.16 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. 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 dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot (15-m) spacing.
8. Upstream and downstream from turning vanes.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts directly or with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

O. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

Q. Install duct test holes where required for testing and balancing purposes.

R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 UTILITY SET FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Loren Cook Company.

B. Description: Direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

C. Housing: Fabricated of galvanized steel with side sheets fastened with a deep lock seam or welded to scroll sheets.

1. Housing Discharge Arrangement: Adjustable to eight standard positions.

D. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

1. Blade Materials: Steel.
2. Blade Type: Backward inclined.
3. Spark-Resistant Construction: AMCA 99, Type [A] [B] [C].

E. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

F. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L_{50} of 200,000 hours.

G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: 1.5.
2. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
3. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
4. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

H. Accessories:

1. Inlet and Outlet: Flanged.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
4. Access Door: Gasketed door in scroll with latch-type handles.
5. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
6. Inlet Screens: Removable wire mesh.
7. Drain Connections: NPS 3/4 (DN 20) threaded coupling drain connection installed at lowest point of housing.
8. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
9. Discharge Dampers: Assembly with parallel blades constructed of two plates formed around and to shaft, channel frame, sealed ball bearings, with blades linked outside of airstream to single control lever of same material as housing.
10. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
11. Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2.2 UPBLAST PROPELLER ROOF EXHAUST FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Loren Cook Company.

B. Description: Direct- or belt-driven propeller fans consisting of housing, wheel, butterfly-type discharge damper, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Wind Band, Fan Housing, and Base: Reinforced and braced galvanized steel, containing galvanized-steel butterfly dampers and rain trough, motor and drive assembly, and fan wheel.

1. Damper Rods: Steel with bronze bearings.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheel: Replaceable, cast-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing; weatherproof housing of same material as fan housing with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Motor Mount: On outside of fan cabinet, adjustable base for belt tensioning.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 8 inches (200 mm).
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Burglar Bars: 1/2-inch- (13-mm-) thick steel bars welded in place to form 6-inch (150-mm) squares.
7. Mounting Pedestal: Galvanized steel with removable access panel.

2.3 CEILING-MOUNTING VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Loren Cook Company.

B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.4 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Loren Cook Company.

B. Description: In-line, [direct] [belt]-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

G. Accessories:

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Sleeve: Galvanized steel to match fan and accessory size.

4. Weathershield Hood: Galvanized steel to match fan and accessory size.
5. Weathershield Front Guard: Galvanized steel with expanded metal screen.
6. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
7. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.5 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Loren Cook Company.
3. Or approved equal by the school district.

2.6 CEILING-MOUNTING VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Loren Cook Company.
3. Or approved equal by the school district.

B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

1. Refer to Schedule on Drawings.
2. Isolation: Rubber-in-shear vibration isolators.
3. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.7 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.8 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using restrained elastomeric mounts having a static deflection of 1 inch (25 mm). Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 233713 – DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers.
2. Perforated diffusers.
3. Louver face diffusers.
4. Linear bar diffusers.
5. Linear slot diffusers.
6. Adjustable bar registers and grilles.
7. Fixed face registers and grilles.
8. Linear bar grilles.

B. Related Sections:

1. Section 089116 "Operable Wall Louvers" and Section 08 91 19 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers (refer to plan and schedules):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Titus
b. Price

c. Nailor

B. Perforated Diffuser (refer to plan and schedules):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Titus
b. Price
c. Nailor

C. Louver Face Diffuser (refer to plan and schedules):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Titus
b. Price
c. Nailor

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Slot Diffuser (refer to plan and schedules):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Titus
b. Price
c. Nailor

B. Fixed Face Register (refer to plan and schedules):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Titus
b. Price
c. Nailor

C. Fixed Face Grille (refer to plan and schedules):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Titus
b. Price
c. Nailor

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 237413 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling.
2. Electric-heating coils.
3. Economizer outdoor- and return-air damper section.
4. Integral, space temperature controls.
5. Roof curbs.

1.2 DEFINITIONS

A. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

B. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

C. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

D. Supply-Air Fan: The fan providing supply-air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

E. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Warranty.

1.4 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigerant system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daiken International.

2. Carrier.
3. Johnson Control.
4. Trane.

2.2 CASING

A. Cabinet: Galvanized steel, phosphatized and finished with an air-dry paint coating and removable access panels. Structural members shall be 16 gauge with access doors an removable panels of minimum 20 gauge.

B. Units cabinet surface hall be tested 500 hours in salt spray test in compliance with ASTM B117.

C. Cabinet construction shall allow for all service maintenance from one side of the unit.

D. Cabinet top cover shall be one piece construction or where seams exist, it shall be double hemmed and gasket sealed.

E. Access Panels: Water and air tight panels with handles shall provide access to filters, heating section, supply air fan section, evaporator coil section and unit control section.

F. Downflow unit's base pans shall have a raised 1-1/8" high lip around the supply and return openings for water integrity.

G. Insulation: Provide 1/2" thick coated fiberglass insulation on all exterior panels in contact with the return and conditioned air stream.

H. The base of the unit shall have provisions for forklift and crane lifting.

I. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1 inch (25 mm).
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

B. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches (50 mm) deep, and complying with ASHRAE 62.1-2004.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple both sides of drain pan.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.3 FANS

A. Direct-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, ECM motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

D. Relief-Air Fan: Forward curved, shaft mounted on permanently lubricated motor.

E. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" when fan-mounted frame and RTU-mounted frame are anchored to building structure.

F. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 COILS

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Coil Split: Interlaced.
4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1-2004.

B. Outdoor-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Two.

B. Compressor: Hermetic, reciprocating, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.

C. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Glass Fiber: Minimum 80 percent arrestance, and MERV 5.

2.7 DAMPERS

A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized damper filter.

B. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

1. Damper Motor: Modulating with adjustable minimum position.
2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1-2004, with bird screen and hood.

2.8 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.9 CONTROLS

A. Control equipment and sequence of operation are specified in Division 23 Section "Instrumentation and Control for HVAC."

B. Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat or sensor with the following features:

a. Fan-speed switch.
b. Automatic changeover.
c. Adjustable deadband.

d. Exposed set point.
e. Exposed indication.
f. Degree F indication.
g. Unoccupied-period-override push button.
h. Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status.

C. DDC Controller:

1. Unoccupied Period:

a. Heating Setback: 10 deg F (5.6 deg C).
b. Cooling Setback: System off.
c. Override Operation: Two hours.

2. Supply Fan Operation:

a. Occupied Periods: Run fan continuously.
b. Unoccupied Periods: Cycle fan to maintain setback temperature.

3. Refrigerant Circuit Operation:

a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain room temperature. Cycle condenser fans to maintain maximum hot-gas pressure.
b. Unoccupied Periods: Compressors off.

4. Fixed Minimum Outdoor-Air Damper Operation:

a. Occupied Periods: Open to 10 percent.
b. Unoccupied Periods: Close the outdoor-air damper.

5. Economizer Outdoor-Air Damper Operation:

a. Occupied Periods: Open to 10 percent fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F (15 deg C). Use mixed-air temperature and select between outdoor-air and return-air enthalpy to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper. During economizer cycle operation, lock out cooling.
b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
c. Outdoor-Airflow Monitor: Accuracy maximum plus or minus 5 percent within 15 and 100 percent of total outdoor air. Monitor microprocessor shall adjust for temperature, and output shall range from 4 to 20 mA.

D. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide LonWorks compatible interface for central HVAC control workstation for the following:

a. Adjusting set points.
b. Monitoring supply fan start, stop, and operation.
c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature.
d. Monitoring occupied and unoccupied operations.

2.10 ACCESSORIES

A. Coil guards of painted, galvanized-steel wire.

B. Hail guards of galvanized steel, painted to match casing.

2.11 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or II.
b. Thickness: 2 inches (50 mm).

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

C. Curb Height: 14 inches (355 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting: Install RTUs on concrete base using elastomeric mounts. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Minimum Deflection: 1/4 inch (6 mm).

B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

C. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

D. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

E. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.
5. Install normal-weight, 3000-psi (20.7-MPa), compressive strength (28-day) concrete mix inside roof curb, 4 inches (100 mm) thick. Concrete, formwork, and reinforcement are specified in Division 03.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.3 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

END OF SECTION 237413

SECTION 238239 - UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cabinet unit heaters with centrifugal fans and electric-resistance heating coils.
2. Propeller unit heaters with electric-resistance heating coils.
3. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Location and size of each field connection.
3. Equipment schedules to include rated capacities, furnished specialties, and accessories.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.4 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

A. Control devices and operational sequences are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

2.2 WALL AND CEILING HEATERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Berko Electric Heating; a division of Marley Engineered Products.
2. Chromalox, Inc.; a division of Emerson Electric Company.
3. Indeeco.
4. Markel Products; a division of TPI Corporation.
5. Marley Electric Heating; a division of Marley Engineered Products.
6. Ouellet Canada Inc.
7. QMark Electric Heating; a division of Marley Engineered Products.
8. Trane.

D. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

E. Cabinet:

1. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

F. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.

G. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection.

H. Fan: Aluminum propeller directly connected to motor.

1. Motor: Permanently lubricated, multispeed. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

I. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.

J. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

C. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

D. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

E. Comply with safety requirements in UL 1995.

F. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 238239

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceways and cables.
2. Sleeve seals.
3. Demolition and renovation work.
4. Common electrical installation requirements.

1.2 SUBMITTALS

A. Product Data: For sleeve seals.

1.3 COMMON ELECTRICAL INSTALLATION REQUIREMENTS:

A. Furnish all labor and material, appliances, equipment and supervision to put in place a complete and functioning electrical system, ready for operation as specified herein and as indicated on the Drawings. System shall include, but not necessarily be limited to the following major equipment or operations:

1. Complete Lighting System: Interior and Exterior.
2. Complete Power Distribution System Expansion.
3. Panels, Safety Switches and Control Equipment.
4. Branch Circuits, Wiring and Devices.
5. Voice/Data Raceways.
6. Electrical Services to Mechanical Equipment, Final Connection and Testing.
7. New Addressable Fire Alarm System.
8. Power for Miscellaneous Technology Equipment.
9. New Incoming and Distribution Raceways for Telecommunication Systems.

1.4 DEFINITIONS:

A. “Provide” shall mean “furnish and install” or “furnish labor and material required for installation of”.

1.5 SITE EXAMINATION:

A. Examination of the site is mandatory. Contractor is hereby held to have examined the site and have satisfied himself as to the conditions under which the work will be performed and have included in his Bid price all costs related thereto.

1.6 QUALITY ASSURANCE:

A. References to standards, codes, Specifications, recommendations etc., shall mean the latest edition of such publications adopted and published at date of invitation to submit Bid Proposals.

B. In addition to requirements shown or specified, comply with the applicable standards, specifications and codes listed below. Where requirements of the Contract Documents are in excess of these requirements, the Contract Documents shall govern.

C. The following associations, codes, standards and abbreviations are included herein by reference:

ANSI	American National Standards Institute
DEQ	Department of Environmental Quality (for the state in which work occurs)
NEC	National Electrical Code
NECA 1	Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000.
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
UL	Underwriters' Laboratories, Inc.

D. Approved manufacturers shall be considered for material in accordance with the requirements of Divisions 26 and 28, subject to the approval of the Architect/Engineer. Such approval applies to the manufacturer only and does not in any way act to permit any deviation from strict compliance with the requirements of these Specifications.

1.7 SUBMITTALS:

A. Submit Shop Drawings for all major components or systems of the project, and where specified.

B. Refer to Architectural Divisions for Shop Drawings to be submitted in transparency form, procedure and other pertinent data. For brochures and other non-reproducible forms of Shop Drawings, submit to the Architect for review, the required number of copies of Shop Drawings, of each piece of equipment and/or apparatus to be used, together with such descriptions and/or explanatory notes as may be required to give a clear idea of its arrangement and construction.

C. Where items are referred to by symbolic designation on the drawings and specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical specifications for additional requirements. Submit the following in addition to any other specified systems/equipment.

1. Power Distribution Equipment
2. Disconnect Switches
3. Contactors
4. Time Switches
5. Wiring Devices & Coverplates
6. Lighting Fixtures, Lamps, Ballasts, Emergency Ballasts
7. Identification
8. Lighting Controls
9. Fire Alarm System

D. No apparatus or equipment shall be shipped from stock or fabricated until Shop Drawings for same have been stamped “Reviewed” or “Reviewed as Noted”. If “Reviewed as Noted” status is applied all review comments must be incorporated for equipment to be ordered/fabricated and for work to proceed.

E. Submit system components, product data and shop drawings complete for each system under one submittal. Do not break out equipment for one system between multiple submittals.

F. If different systems are included in one submittal, clearly separate information with tabs or binding and provide different sub-numbering of systems.

G. All Shop Drawings must be clearly marked to show equipment submitted and any deviations from specifications shall be noted in writing. Deviations not specifically noted in writing will be the Contractors responsibility to replace if installed. Do not include only model numbers to indicate submitted equipment. Model numbers/ordering numbers will not be reviewed. Edited product data will be reviewed. Strike out any information on product data that is not project specific, and edit relevant information to show actual equipment submitted. Electrical Contractor must review, sign and approve all shop drawings prior to submittal.

H. Identify submitted equipment with nomenclature indicated on the Contract Documents.

I. Provide project specific submittals from contractor to reviewer rather than supplier/manufacturer to reviewer. Do not include any claim of work or product “by others” if the work is the contractor’s responsibility. Contractor’s signature on submittal indicates that contractor finds submitted equipment and systems to meet contract document requirements.

J. Uniquely and consecutively number each page in submittal.

K. Shop Drawings that are incomplete, unsigned and not plainly marked will not be reviewed.

L. Coordinate submittal schedule and construction schedule with CM/GC. Provide complete, accurate submittals to avoid re-submittals. Time required for any re-submittals is to be planned into project schedule by the Contractor. The A/E will not be responsible for construction delays due to re-submittals and will not be required to accelerate re-submittal review times. Pricing changes will not be approved due to re-submittals. Include in bid all costs required to allow for re-submittals.

1.8 CONTRACT DRAWINGS:

A. Contract Drawings for electrical work are diagrammatic, intended to convey the scope of the work and indicate general arrangement of systems and approximate locations of equipment and outlets. Do not scale Drawings for measurements.

B. Consult Architectural, Structural and Mechanical Contract Drawings and Specifications to become familiar with all conditions affecting the work, coordinate interconnecting work and other Trades affected, and verify all spaces in which the work will be installed.

C. Where job conditions require reasonable changes in indicated locations and arrangements, make changes without extra cost to the Owner.

D. The Contract Documents (Drawings and Specifications) are to be cooperative, and whatever is called for by either shall be binding as if called for by both.

E. Various items of apparatus and equipment will be furnished and set under other Contracts.

F. Remove and reinstall ceilings, including outside the renovation areas, as required to perform work. Reinstall ceilings to pre-construction condition or better, subject to review and approval of the Architect.

1.9 WORK INVOLVING OTHER TRADES:

A. Certain items of equipment or materials specified in the Electrical Division may have to be installed by other Trades such as Mechanical Trades or Architectural Trades due to code requirements or union jurisdictional requirements. Where this occurs, Electrical Trades shall include the full cost for completing the work installed by others.

B. Include allowance in bid for variations in electrical services (branch circuits/feeders) to mechanical equipment specified. Equipment specified and designed into Contract Documents may vary due to manufacturer differences and equipment selections and substitutions. Allow for revisions to services with no extra charge prior to installation. Coordinate with approved mechanical submittals to verify equipment characteristics prior to beginning electrical installation.

C. Provide raceways and/or power sources for other trades where noted on their documents.

1.10 RECORD DRAWINGS:

A. After completion of the work, provide a complete set of “Record” Drawings to Owner and the Engineer. Submit updated electronic Auto Cad files along with a set of marked up drawings with as-built changes for final approval.

B. In addition to hard copy, submit on compact disks electronic versions of as built panel schedules. Submit to A/E and to Owner’s Building Engineer in Microsoft excel format. Match format of schedule used for construction documents. Template file is available to Contractor from Engineer upon request.

1.11 CODES, PERMITS, INSPECTIONS AND FEES:

A. All work shall be in accordance with National Electrical Code, latest edition and all local, state and national bodies having jurisdiction thereof.

B. Contractor shall be licensed in the municipality in which the work is located.

C. Contractor shall take out all permits required and arrange for all necessary inspections, licenses and approvals as required by local and state laws and shall pay all fees and expenses in connection therewith, and shall include same in Base Bid prices. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

D. Upon completion of the work, furnish to the Engineer all certificates of inspection and/or approvals which are customary for the classes of work involved.

1.12 COORDINATION AND COOPERATION:

A. Electrical Contractor shall coordinate his work with that of the Construction Manager/General Contractor as applicable and other Subcontractors for the Project.

B. Contractor shall coordinate with designated Representative the placing of panels, flush devices or other equipment installed in masonry walls or partitions. All such flush installations shall be coordinated with masonry coursing as applicable.

C. Chases and recesses are provided by the architectural trades, but the contractor shall be responsible for their accurate location and size.

1.13 SCHEDULING OF WORK:

A. Work may be scheduled in phases and/or may be performed on a fast-track schedule. Prior to bid submission, coordinate with GC/CM and with Owner to determine project schedule. Include in bid all costs to achieve completion of work within project schedule.

1.14 USE OF EQUIPMENT:

A. The use of any equipment, or any part thereof, for any purpose including testing even with the Owner’s consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor shall it be construed to obligate him in any way to accept improper work or defective materials.

B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

1.15 PROPOSED SUBSTITUTIONS AND CONTRACTOR’S RESPONSIBILITY:

A. Manufacturers other than those listed in Division 26 and may be listed for consideration in bid proposal with add or deduct costs from listed manufacturer.

B. Any substitutions contemplated shall be subject to the final approval of the Architect/Engineer at their sole and absolute discretion prior to bid award. After bid award all products submitted shall comply with Contract Documents.

C. Substitute equipment and material submittals shall be complete and clear and shall include all data required to establish equal quality, to specified and indicated products.

D. Substitutions will be considered only once and if found lacking in detail or required supportive data, or if they are not found to be equal by the A/E review, they will be rejected outright, and such rejection shall be final. Substitutions and changes to products will not be considered after the product has been approved or approved as noted with comments in a submittal.

E. "Approved Equal" equipment, material or systems are intended to provide the same quality, aesthetics and performance and function as those named and are not considered as substitutes for the purpose of this article. The Architect/Engineer will review products submitted as equal and will allow or disallow their use in the project. If submitted products are not determined to be equal by the Architect/Engineer for any reason, provide the specified/listed product at no change in project cost. The Contractor's bid is to include all costs to comply with specified/indicated work. Changes in costs will not be approved for equal products.

F. Submit product data and written description of how proposed substitution varies from specified product. Any characteristics not specifically submitted in writing as a deviation from the Contract Documents will be assumed to conform to the intent of the specified product.

G. Submit project cost increases or deductions that result from the acceptance of each substitution. Additional cost to the project will not be approved unless specifically included with the substitution.

1.16 OPERATION AND MAINTENANCE MANUALS:

A. Upon completion of the work and fourteen (14) days before final inspection, the Contractor is to compile and deliver to the Architect, three (3) sets of Manuals of material and equipment used in the building. This shall include, but shall not be limited to, transformers, light fixtures, panels, switches, wiring devices, lighting controls, fire alarm systems, etc.

B. In each set of manuals, the following information shall be included for each item of material, equipment and hardware installed:

1. Name and address of manufacturer and/or fabricator.
2. Trade names, catalog number, serial number, contract number of other accurate provision for ordering replacement and spare parts.
3. Certified Drawings, where applicable, showing the amount of parts and general dimensions.
4. Operating and maintenance instructions and/or manuals.
5. Routine maintenance procedures.
6. Trouble-shooting procedures.
7. Shop drawings and product data.

1.17 TEMPORARY LIGHT AND POWER:

A. Consult Architectural Divisions for requirements pertaining to this work and comply.

B. Provide complete systems of adequate capacity and design, and in accordance with Federal, State and Local Codes.

1.18 CONSTRUCTION POWER:

A. Contractor to provide for all trades.

1.19 TRAINING:

A. Provide training to Owners personnel as specified in individual specification sections.

B. Hours of training in each section are the actual time spent training Owners personnel. Travel and preparation time are not included in this time.

1.20 WARRANTY:

A. Unless a longer period is specified in individual specification sections, provide a minimum of a one year warranty on all electrical work beginning the date of final acceptance of the project by the Owner. A manufacturer's warranty on equipment shall be extended a minimum of one year from final project acceptance. Manufacturer's warranties which are longer than a one year term shall remain in effect for their entire length.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or 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. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [steel] [cast-iron] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use 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.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.5 PROTECTION AND HANDLING:

A. All electrical systems or divisions thereof shall be duly cared for and properly protected until all systems have been completely tested, inspected and finally accepted by Owner.

B. After delivery, before and after installation, protect equipment and material against theft, injury or damage from all causes.

C. Protect equipment outlets, conduit openings and electrical raceways with temporary plugs or caps.

D. Receive, properly house, hoist, handle and deliver to the proper location, equipment and material required for this Division of the work.

E. Deliver materials to the job site in original containers and packages, bearing the manufacturer's labels indicating name, type and brand.

3.6 PAINTING, CLEANING AND TOUCH-UP:

A. Any required painting of electrical equipment in existing areas will be done by Architectural Trades. Whenever painting is required by this Trade for certain portions of the work, it will be specifically specified hereinafter.

B. All factory finished equipment shall be thoroughly cleaned at the completion of the work. Any equipment showing mars or rust spots shall be refinished and restored to original factory finish.

3.7 ELECTRICAL REQUIREMENTS FOR MECHANICAL WORK:

A. Motor starters, except for those included with packaged mechanical equipment, will be furnished and installed by the Electrical Trades Contractor. These starters will be sized and shown on the Electrical Drawings. Verify sizes required in coordination with Mechanical Trades documents prior to purchase.

B. Furnish and install disconnects for mechanical and building equipment requiring the same unless otherwise specified herein or noted, to meet NEC requirements.

3.8 BUILDING EQUIPMENT AND HVAC/MECHANICAL EQUIPMENT:

A. Provide and install all electrical work required to put in operation building and mechanical equipment requiring electrical service. See mechanical documents for additional information.

B. Connections to new equipment shall be done in accordance with manufacturer's Shop Drawings and installation instructions. Requirements generally vary from one manufacturer to another and Contractor is bound to comply and provide all work as required although certain discrepancies regarding requirements may exist. All additional connections not shown on the drawings but called out by manufacturers' shop drawings shall be provided.

C. Provide power wiring, protection and disconnect devices to all mechanical equipment and make final connections, including testing and motors for proper rotation. Exhaust fans may be provided with integral disconnects by Mechanical Trades.

D. Packaged equipment is provided as a unit by manufacturer including all control and power wiring at a main junction box. Install disconnect switch, power wiring and make final connections.

3.9 MOUNTING HEIGHTS:

A. Height above finished floor for all control and wiring devices shall be in accordance with the Americans With Disabilities Act (ADA). Switches shall not be more than 48" above finish floor (AFF). General purpose receptacles shall not be less than 12" AFF and no more than 48" AFF.

B. General purpose convenience receptacles shall be mounted at 16" AFF to the bottom of outlet box. Telephone outlets shall be installed at the same height as receptacles except for wall mounted instruments, outlets shall be installed at 48" AFF.

C. Light control switches, dimmers, manual starters and similar devices shall be generally mounted at 48" AFF.

D. Consult Drawings for special mounting heights, base mounted devices, horizontally mounted receptacles and other special mounting requirements.

E. Receptacles in Toilet Rooms, Janitor Closets and Mechanical Rooms shall be installed at 48" AFF. Receptacles and switches at counters shall be installed at 6" above counter measured to the center of the box. Height of special devices shall be as indicated on the Drawings or as directed.

F. Mounting heights indicated on the Drawings shall take precedence over the requirements stated herein.

G. Whenever the mounting heights of any device is in question, consult the Architect for direction prior to roughing-in.

3.10 RESPONSIBILITY FOR VOLTAGE VERIFICATION:

A. Contractor shall be responsible for verification of correct voltages for all mechanical and building equipment. In case of discrepancy, notify Engineer immediately and prior to Shop Drawing submittals. Failure to comply with this requirement holds Contractor fully responsible for any subsequent equipment revisions and work.

3.11 RESPONSIBILITY FOR SUBSTITUTIONS:

A. In the event that substitute equipment, material or whole systems are approved for use on the project, the Trade Contractor using the substitute material, equipment or systems shall pay all subsequent additional costs; that may be incurred for proper implementation, function and use of such equipment; In addition, the Trade Contractor shall pay for all time expended by the Architect and/or Engineer relative to the substitution.

3.12 WIRING METHODS:

A. Contractor may utilize existing conduits and outlet boxes provided they are in acceptable condition to Authority Having Jurisdiction.

B. Re-support existing reused conduit and boxes if required. If contractor chooses not to reuse existing raceways, include in bid work for providing new raceways.

C. Provide new raceway where specified and indicated and where existing raceways are not in satisfactory condition to Authority Having Jurisdiction.

D. Provide pricing to re-support existing to remain conduit and boxes above finished ceilings in renovation area if required. Provide separate add alternate as line item price in bid for work, and perform work only if directed by Owner/GC/CM.

3.13 EXPOSED WORK:

A. It is the intent of the overall design to conceal all work except in unfinished areas. Contractor shall utilize wall and ceiling spaces to conceal all work.

B. Only in cases where it is impossible to conceal the work, short exposed metal surface raceways (not conduit) may be used subject to approval of Architect. Paint to match wall.

3.14 SURFACE REPAIR:

A. Repair finished surfaces around removed electrical equipment to match final finished condition. Coordinate with Architect for finish requirements.

END OF SECTION 260500

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THW and THHN-THWN.

C. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire. Cable may be used above accessible ceilings between lighting fixture and box only – maximum 6’ length.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.

5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Metal-clad cable, type MC between box and lighting fixture only above ceilings maximum 10'.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

G. All conductors shall be insulated for 600 volts with 90ºC code grade insulation.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. 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.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

C. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both wall surfaces.

E. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Section "Joint Sealants."

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Section "Penetration Firestopping."

J. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors, for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.

b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch by10 in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
4. Provide ground bus with #4 ground in each 1DF, MDF, and similar rooms.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 5 ohms.
2. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Grind smooth exposed sides and edges.

B. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel set-screw type.

2.2 NONMETALLIC CONDUIT AND TUBING

A. ENT: NEMA TC 13.

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

C. LFNC: UL 1660.

D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

E. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type and 3R, unless otherwise indicated.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Wireway Covers: Hinged type, Screw-cover type, and as indicated.

F. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers and devices indicated. Prime coating, ready for field painting.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division (G4000).

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast or sheet metal, fully adjustable rectangular. Provide with devices indicated and slide or fix covers to be UL rated for scrub water exclusion wiremold, Hubbell.

E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2.6 COMBINATION DATA AND TELEPHONE OUTLET

A. Voice only outlets (such as wall phones) shall consist of a double gang outlet box, minimum 2-1/8” deep, with single gang plaster ring and no cover plate.

B. Voice/data combination outlets shall consist of a 4” square outlet box, minimum 2-1/8” deep, with single gang plaster ring and no cover plate.

C. From each outlet provide a 3/4" EMT or RSC to an accessible location above the finished ceiling and terminate with an insulating bushing at both ends. Do not provide flexible metal conduit for voice/data outlets.

D. Cover plates and proper jacks will be provided by others under separate Contract with Owner.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel.
2. Concealed Conduit, Aboveground.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage.
2. Exposed and Subject to Severe Physical Damage: Includes raceways in the following locations:

a. Mechanical rooms.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: Rigid steel conduit.
6. Raceways for Optical Fiber or Communications Cable: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.
8. MC Cable may be used above ceiling from box to fixture maximum 10'.
9. Conduits larger than 2-1/2": Rigid steel.

C. Minimum Raceway Size: 3/4-inch trade size unless otherwise noted.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

K. Raceways for Optical Fiber and Communications Cable: Verify with Telecommunication Contractor.

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

L. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

M. 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.

N. Set metal floor boxes level and flush with finished floor surface.

O. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on white field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

    a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    b. Colors for 208/120-V Circuits:

        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.
        4) Neutral: White.

    c. Colors for 480/277V circuits:

        1) Phase A: Brown.
        2) Phase B: Pink.
        3) Phase C: Purple.
        4) Neutral: Grey.

    d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Outdoor photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.
5. Lighting control panel.

B. See Division 26 Section "Network Lighting Controls" for low-voltage, manual and programmable lighting control systems.

C. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc.
2. Leviton Mfg. Company Inc.
3. Paragon Electric Co.; Invensys Climate Controls.
4. Square D; Schneider Electric.
5. TORK.

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: As shown on drawing.
2. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
4. Astronomic Time: All Selected channels.
5. Battery Backup: For schedules and time clock.

2.2 OUTDOOR & INDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc.
2. Paragon Electric Co.; Invensys Climate Controls.
3. TORK.
4. Leviton
5. Sensor Switch
6. Watt Stopper

B. Description for outdoor photocells: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

C. For indoor photoelectric sensors refer to part 2.5 this section.

2.3 MICHIGAN UNIFORM ENERGY CODE – LIGHTING CONTROL SYSTEM

A. This is a performance based design-build specification.

B. The intent of this specification item is for full compliance with the requirements of the Michigan Uniform Energy Code and related amendments as they apply to the ASHRAE 90.1-1999 Standard.

C. Design and provide a complete lighting control system per manufacturer's recommendation. Indicate all components on as-built documentation. Coordinate with architectural trades to provide ceiling access panels where required.

D. Provide local wall switches on-off type in addition to relay/contactor control. Coordinate voltage of switches (line/low voltage) as required for each space. Where spaces are controlled with relay panel, provide manual override for up to 4 hours with local switches. Refer to “Lighting Control Relay Panel”, this Section, for additional requirements.

E. Provide fixtures with tandem wired ballasts as required to comply with ASHRAE 90.1.

F. Indicate location of relay/power packs and all other above – ceiling components in the as-built documentation. Indicate which components control which fixtures.

G. Refer to the lighting drawings and to Branch Distribution and Control Equipment and Lighting Systems, for coordination with fixtures, circuiting and switching.

H. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

I. Submit any interconnection diagrams per major subsystem showing proper wiring.

J. Submit catalog sheets which clearly state any load restrictions.

K. Manufacturers: Subject to compliance with requirements provide products by Leviton, Sensor Switch, Watt Stopper or Lutron.

2.4 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D or a comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Hubbell Lighting.

B. Description: Electrically operated and mechanically held combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices.

2.5 LIGHTING CONTROL RELAY PANEL

A. Provide a standalone lighting control relay panel and LCD display in a flush mounted or surface mounted enclosure, suitable for operation on 120VAC control power. Provide lockable front cover. Turn over minimum two keys to Owner.

B. Panel shall contain integral astronomical time clock with automatic daylight savings, leap year adjustments, and capability to program site location information into time clock for use with sunrise/sunset settings.

C. Refer to Michigan Uniform Energy Code, this Section, and to plan drawings for loads controlled by relay panel.

D. Coordinate quantity of relays and panels with circuits being controlled. In each relay panel in the project, provide minimum 10% spare relays in addition to those required for controlled circuits.

E. Coordinate voltage of relays with circuits being controlled. Provide 1-pole relays for 120V and 277V applications, and 2-pole relays for 208V applications. Provide voltage barrier for separation of relays controlling different voltages.

F. Panel is to include circuitry for switching full load at the zero-crossing of the AC current waveform. Relays are to be normally open.

G. Provide low voltage switches and photoelectric controls which are compatible with control panel. Identify low voltage switch coverplates except add a second line of identification to indicate control through relay panel (e.g. “LP-1A-3,” and “Via Relay Panel.”)

H. Provide low voltage automatic control override Master Switches at locations determined by the Owner with operation as specified. Coordinate compatibility of switch with panel and with operation as specified. Label switch coverplate as specified for wiring devices, except indicate relay panel controlled and geographic location of circuits controlled, e.g. “Relay Panel R-11, Master Switch” or applicable building wing. Program relay panel to operate with low voltage automatic control override switch as follows:

1. Override on: pressing The Master Switch with circuits off will turn on all relay-controlled branch circuits in the panel for a maximum of four hours, and then automatically shut circuits off after time expires. Circuits will remain off until the switch is pressed again, or until the next programmed automatic on-time occurs.
2. Override off: pressing The Master Switch with circuits on will turn off all relay-controlled branch circuits in the panel. Circuits will remain off until the switch is pressed again, or until the next programmed automatic on-time occurs.

The programmed control of the circuits above is to operate independently of any local space control.

I. Program panel to flash lights prior to automatically turning them off.

J. Coordinate quantity of circuits required and application of low voltage switches as specified in Michigan Uniform Energy Code, this Section.

K. Provide data outlet mounted adjacent to panel for remote programming and/or connection to Owner’s computer network.

L. Include control panel startup/commissioning and training by manufacturer's factory-trained personnel. In addition to other startup requirements, manufacturer's factory representative is to obtain Owner's desired operational schedule for each circuit, program panel with site-specific information, and control lighting fixtures per Owner's schedule in compliance with Michigan Uniform Energy Code.

M. Provide Owner with a minimum of 2 hours of training at jobsite by manufacturer's factory representative.

N. Manufacturers

1. Leviton Z-Max
2. Sensor switch

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section "Low-Voltage Electrical Power Conductors and Cables" and this Section.

PART 3 - EXECUTION

3.1 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

B. Mount in panelboard where shown on plans.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.5 LIGHTING CONTROL RELAY PANEL INSTALLATION

A. Provide 120V control power circuit (3/4"C, 2#12 & 1#12G) from local panelboard to relay panel. Identify branch circuit used in as-built documentation. Circuit is not specifically identified on plan drawings.

B. Control branch circuits through relay panel as specified in "Lighting Control Relay Panel" and in "Michigan Uniform Energy Code", this Section.

C. Identify relay panel with plastic laminate nameplate indicating the equipment and the branch circuit serving the equipment (e.g. "Lighting Control Relay Panel, Control Power Circuit RP-A-32.")

D. Provide circuit directory inside relay panel cover. For each relay/circuit controlled, identify the following as-built and programmed conditions:

1. Line voltage panelboard and branch circuit number.
2. Associated relay number.
3. Room/location of controlled load.
4. Control scheme for load (e.g. time clock, photocell, or occupancy sensor control).
5. For each circuit controlled by time clock, indicate programmed on and off times.
6. Spares.

E. For flush mounted panels provide the following:

1. Three 1" C spare from adjacent lighting/receptacle panel to the relay panel.
2. Three 1" C spare from the relay panel to above the nearest accessible finished ceiling.

END OF SECTION 260923

SECTION 262413 – MAIN SWITCHBOARD

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term “withstand” means “the unit will remain in place without separation of any parts form the device when subjected to the seismic forces specified.”

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory and component indicated. Include dimensions and manufacturers’ technical data on features, performance, electrical characteristics, ratings and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections and details. Show tabulations of installed devices, equipment features and ratings.
2. Detail enclosure types and detail for types other than NEMA 250, Type 1.
3. Detail bus configuration, current and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation and maintenance manuals. In addition to items specified in Division 01 Section "Operating and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustment.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete and temporary HVAC system to operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F (plus 40 deg C).
b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression device that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MAIN SWITCHBOARD

A. Manufacturer:

1. Eaton
2. Square D.
3. Siemens
4. GE

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

C. Nominal System Voltage: 208Y/120V, 3 Phase.

D. Main-Bus Continuous: See Riser Diagram. Minimum 65K A.I.C. rated for service entrance.

E. Enclosure: Steel, NEMA 250, Type 1.

1. Enclosure Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

F. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

G. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

H. Phase and Neutral Buses and Connections: Three phase, four wire unless otherwise indicated. Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.

1. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) minimum size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors.
2. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
3. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables.

I. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of compartment.

J. Customer metering.

2.2 TRANSIENT VOLTAGE SURGE SUPPRESSOR (TVSS):

A. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, bolt-on, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, short-circuit current rating complying with UL 1449, second edition and matching or exceeding the panelboard short-circuit rating, redundant suppression circuits, with individually fused metal-oxide varistors.

1. Accessories:

a. Fuses rated at 200-kA interrupting capacity.
b. Fabrication using bolted compression lugs for internal wiring.
c. Integral disconnect switch.
d. Redundant suppression circuits.
e. Redundant replaceable modules.
f. Arrangement with wire connections to phase buses, neutral bus and ground bus.
g. LED indicator lights for power and protection status.
h. Audible alarm, with silencing switch, to indicate when protection has failed.
i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
j. Transient-event counter set to totalize transient surges.

2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
3. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
4. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, three-phase four-wire circuits shall be as follows:

a. Line to Neutral: 400 V for 208Y/120.
b. Line to Ground: 400 V for 208Y/120.
c. Neutral to Ground: 400 V for 208Y/120.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. High-Pressure, Butt-Type Contact Switch: Operating mechanism uses butt-type contacts and a spring-charged mechanism to produce and maintain high-pressure contact when switch is closed.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Square D Company, Eaton, Siemens, GE.

2. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.

a. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.

3. Service-Rated Switches: Labeled for use as service equipment.

B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

C. Fuses are specified in Division 26 Section "Fuses."

2.4 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

a. Phase Currents, Each Phase: Plus or minus 1 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
d. Megawatts: Plus or minus 2 percent.
e. Megavars: Plus or minus 2 percent.
f. Power Factor: Plus or minus 2 percent.
g. Frequency: Plus or minus 0.5 percent.
h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

2.6 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technologies; a subsidiary of Danahar Corporation.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial – Electrical Distribution.
4. Liebert Corporation.
5. Siemens Energy & Automation, Inc.
6. Square D; a brand of Schneider Electric.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent device test, inspection, maintenance and operation.

PART 3- EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle and store panelboards according to NECA 407.

B. Examine switchboard before installation. Reject switchboard that is damaged or rusted or has been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLTION

A. Install according to NECA 407.

B. Comply with mounting and anchoring requirements specified in Section “Vibration and Seismic Controls for Electrical Systems.:

C. Install overcurrent protective devices and controllers not already factory installed.

D. Install filler plates in unused spaces.

E. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring and components; provide warning signs complying with Section “Identification for Electrical Systems.”

B. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section “Identification for Electrical Systems.”

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test and adjust components, assemblies and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use and infrared scanning device designated to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.7 DTE COMPANY CT COMPARTMENT TO BE BUILT PER UTILITY COMPANY REQUIREMENTS.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Field quality-control reports.

E. Panelboard schedules for installation in panelboards.

F. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.
5. Provide new directories for all panels disturbed due to new work. Identify all circuits, new and existing to remain.
6. Provide new interiors for existing panelboards where shown.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus Configured Terminators: Mechanical type.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

H. Provide TVSS units for all receptacle panelboards serving classroom, office or similar area receptacles or electronic equipment.

2.2 DISTRIBUTION PANELBOARDS AND POWER PANELBOARDS

A. Manufacturers: Square D, Eaton, Siemens, GE.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Lugs only, unless otherwise noted.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Bracing: 65,000 minimum short circuit current at operating voltage.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Square D, Eaton, Siemens, GE.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Bracing: 10,000 minimum short circuit current at 240V.
14,000 minimum short circuit current at 277V.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Square D, Eaton, Siemens, GE.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Remote-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

F. Install filler plates in unused spaces.

G. Stub four 1-inch (27-GRC) empty conduits from flush mounted panelboard into accessible ceiling space or space designated to be ceiling space in the future.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

J. Place all spare breakers in “off” position.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Identify all circuits including circuits to remain in reused existing panels.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems." Include nomenclature and voltage.

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch.
6. Communications outlets.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
2. Leviton Mfg. Company Inc. (Leviton).
3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL5351 (single), CR5362 (duplex).
b. Leviton; 5891 (single), 5362 (duplex).
c. Pass & Seymour; 5381 (single), 5362 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pass & Seymour; 2094.
b. Approved equal by Leviton or Hubbell.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
b. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
c. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HPL1221PL for 120 V and 277 V.
b. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
c. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1221L.
b. Leviton; 1221-2L.
c. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces satin-finished stainless steel 0.04-inch- (1-mm-) thick.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations". Receptacle to be accessible with cover in closed position.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover. Receptacle to be accessible with cover in closed position.

2.6 FLOOR SERVICE FITTINGS

A. General Floor Mounted Service Fitting:

1. Service fittings in first paragraph below are available for voice and data communication cabling as well as for power. Edit to suit Project.
2. Type: Modular, flap-type, dual-service units suitable for wiring method used.
3. Compartments: Barrier separates power from voice and data communication cabling.
4. Service Plate: Brass with brass carpet flanges where required.
5. Power Receptacle: NEMA WD 6 configuration 5-20R unless otherwise indicated. Finish to be chosen by Architect.
6. Voice and Data Communication Outlet: Blank cover with bushed cable opening.
7. Equal to Hubbell #B2432 (2 gang with duplex receptacle and data/voice) or #B2433 (3 gang with (2) duplex receptacles and data/voice. Covers to be equal to Hubbell #S3826.

B. Multi-Service Flush Floor Box Large Capacity Type F1:

1. Provide four-compartment, combination power and communications, flush mounted, stamped steel floor box with two duplex receptacle and two communications brackets. Coordinate communication bracket type with Owner.
2. Provide floor port activation cover.
3. Provide four 20A, 125V, duplex receptacles in Power compartment with 1” conduit for branch circuiting indicated. Route conduit concealed from box to panelboard. Identify receptacle branch circuits as specified for wiring device coverplates, this Section.

4. Provide three 1"c empty from A/V and telecom compartments concealed to nearest accessible ceiling location.
5. Provide flanges or flangeless trim components suitable for floor finish (tile or carpet). Coordinate with Architect for appropriate components and finish. Coordinate finish color of all exposed components with Architect prior to submittal – black, brushed aluminum or brass and provide carpet or tile in insert as directed by Architect. Include Architect-approved color and coordinated trim components with submittal.
6. Manufacturers: Walker Resource RFB-4 Series or approved equal by Hubbell.

2.7 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cartridge fuses rated 600-V ac and less for use in enclosed switches, panelboards, switchboards and enclosed controllers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Motor Branch Circuits: Class RK1, time delay.

B. Other Branch Circuits: Class RK1, time delay.

C. Control Circuits: Class CC, time delay.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

D. Field quality-control reports.

E. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Square D, Eaton, Siemens, GE.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three 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. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Square D, Eaton, Siemens, GE.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

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: Suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Square D, Eaton, Siemens, GE.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.
3. Multispeed.

1.2 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed controller.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.

D. Field quality-control reports.

E. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers: Square D, Eaton, Siemens, GE.
2. Configuration: Nonreversing Two speed where required.
3. Surface mounting.
4. Pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Square D, Eaton, Siemens, GE.
2. Configuration: Nonreversing Two speed where required.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button bimetallic type.
4. Surface mounting.
5. Pilot light.

D. Combination Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Square D, Eaton, Siemens, GE.
2. Contactor Coils: Pressure-encapsulated type.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
4. Control Circuits: 120 -V ac; obtained from integral CPT, with primary and secondary fuses of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
5. Melting Alloy Overload Relays:

a. Inverse-time-current characteristic.
b. Class 10 tripping characteristic.
c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

6. External overload reset push button.
7. Provide with “hand-off-auto” selector switch and pilot lights.
8. Fusible Disconnecting Means:

a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.
3. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.3 ACCESSORIES

A. Push Buttons, Pilot Lights, and Selector Switches: NEMA ICS 5; heavy-duty type; factory installed in controller enclosure cover unless otherwise indicated.

B. Control Relays: Auxiliary and adjustable time-delay relays.

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

B. Install fuses in each fusible-switch enclosed controller.

C. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

D. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

E. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager before increasing settings.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section "Wiring Devices" for manual wall-box dimmers.

1.2 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
    b. UV stabilized.

2.3 EMERGENCY LED POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate LED lamp(s) continuously at an output as indicated on plans or minimum 1100 lumens if not indicated. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture driver.
2. Nightlight Connection: Operate lamp continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 BALLASTS FOR HID LAMPS

A. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.
11. Pulse start unless otherwise noted on plans.

2.5 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps, drivers and ballasts.

1.2 SUBMITTALS

A. Product Data: For each luminaire, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected from manufacturer's standard catalog of colors.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Provide reinforced concrete bases for all pole mounted luminaires complete with grounding wire.

1. Provide final finish on exposed portions of bases. Grind smooth sides and edges of bases.

END OF SECTION 265600

Section 270000 - General Technology Requirements

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.
B. Related Specification Sections:
   1. 271000 – Structured Cabling & Communications Equipment Room Fittings
   2. 274000 – Integrated A/V Systems & Equipment
   3. 278000 – Network Infrastructure Equipment

1.02 DEFINITIONS

A. ADA: Americans With Disabilities Act
B. AIA: American Institute of Architects
C. B/W: Black and White
D. DAS: Direct-Attached Storage
E. FBO: Furnished By Other
F. FCC: Federal Communication Commission
G. FF: Fixed Focus
H. IR: Infrared
I. LAN: Local Area Network
J. MPEG: Moving Picture Experts Group
K. NAS: Network-Attached Storage
L. NTSC: National Television System Committee
M. PoE: Power over Ethernet
N. PTZ: Pan/Tilt/Zoom
O. RF: Radio Frequency
P. SAN: Storage Area Network
Q. TR: Telecommunications Room
R. UTP: Unshielded Twisted Pair
S. VMS: Video Management System
T. WAN: Wide Area Network

1.03 SUMMARY

A. The following buildings/sites are part of this project:
   1. Dorothy M. Busch Branch Library (City of Warren), 23333 Ryan Road, Warren, Michigan 48091
A. Integration and Engineering Services.
B. Project Documentation.
C. Technology work provided by others.
   1. None

1.04 GENERAL REQUIREMENTS

A. Contractors are encouraged to visit the job site(s), examine and field verify the conditions at each site where the installation(s) will take place prior to submitting a bid proposal.
B. The Contractor is required to provide all services necessary to design, engineer, procure, construct and verify the Project as specified within the bid package. These services shall conform to manufacturer specifications and applicable industry standards.
C. All material(s) and equipment shall be furnished with all accessories necessary for a complete system.
D. All material(s) and equipment shall be new and standard manufactured products.
E. Any proposed material(s) and equipment with a known end of manufacture date shall be called-out within the Contractor's bid proposal.
F. Contractor(s) is/are to provide all applicable permits, licenses, inspections, approvals, and fees required for a complete solution as part of their bid proposal.
G. Contractor(s) shall utilize plenum rated cable and ties throughout this Project.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The Contractor's base bid shall utilize products and materials from the manufacturers listed in the applicable specification sections. In addition, the Contractor may include equipment and design variations to the base bid as a voluntary alternate.

PART 3 – EXECUTION

3.01 PROJECT MANAGER/ENGINEER

A. The awarded Contractor will provide a Project manager/engineer who will act as a single point of contact for all activities regarding this Project.
B. The Project manager/engineer will be required to make on-site decisions regarding the scope of the work and any changes required by the work.
C. The Project manager/engineer will be totally responsible for all aspects of the work and shall have the authority to make immediate decisions regarding implementation or changes to the work.

3.02 EXAMINATION

A. The Contractor(s) shall choose the appropriate mounting method(s), products, and materials for each location based on manufacturer's specifications and requirements based on building structure, type of wall, etc.

3.03 INSTALLATION

A. Perform all work in a neat and workmanlike manner in accordance with the latest edition of the National Electrical Code, the ANSI/NECA/BICSI-568-2005 Standard for Installing Commercial Building Telecommunications Cabling and Equipment and all ANSI/TIA/EIA standards documents relevant to this Project.
B. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of

the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Architect/Technology Consultant in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

C. Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment.
D. Coordinate with the Architect/Technology Consultant for secure storage of equipment and materials. The Owner is not required to provide a secure storage area.
E. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions.
F. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

3.04 RETROFIT/CUTOVER/DEMOLITION/EQIUPMENT REMOVAL

A. Furnish equipment, materials, labor and services, and perform operations required to retrofit/cutover existing systems. Removals shown are general indications and may not indicate full extent of removals which may be required to complete the scope of work.
B. Furnish equipment, materials, labor and services, and performing operations required to enable continued functioning of existing system until cutover to new system.
C. Remove wiring, punch blocks, cabinets, outlets, raceways, and equipment not required for new system.
D. Provide removals, relocations, and alterations to existing systems, equipment, and materials. Perform the scope of work in neat and workmanlike manner in accordance with the latest edition of the National Electrical Code, the ANSI/NECA/BICSI-568-2005 Standard for Installing Commercial Building Telecommunications Cabling, the BICSI Information Transport Systems Installation Manual, and all ANSI/TIA/EIA standards documents relevant to this Project.
E. Existing equipment or material shall not be reused without specific approval of the Owner except as noted.
F. Equipment and materials to be removed and not desired by the Owner shall be removed from District promptly.
G. All equipment to be removed must be disposed of according to EPA and DOD standards. All owner tags are to be removed and the contractor shall provide certification of disposal per EPA/DOD standards.
H. All equipment removed shall be recorded by Type, Manufacturer, Model, Asset Tag Number and Serial Number.
I. Equipment and material to be removed and that is desired by the Owner shall be moved to an on-site storage location as directed by the Owner.

3.05 REMOVAL AND REPLACEMENT OF EXISTING CEILING TILES

A. Carefully remove existing ceilings as required to perform the work. Store removed tiles in an area designated by the Owner. Modify and augment existing suspension systems as necessary. Restore ceiling systems to their original finish on a daily basis.
B. Repair any damage to ceilings due to modifications, removal, and replacement of same. Replace damaged ceiling tiles, including tiles with holes or openings left as a result of demolition, with materials of like kind.

3.06 CUTTING AND PATCHING

A. Provide openings, cutting, coring, and patching of openings in existing building construction as required. Patching includes openings and voids left in existing construction as a result of demolition.
B. The Work shall include necessary assemblies and materials to maintain required fire ratings.
C. Perform cutting as to not impair structural stability of building construction and systems. Do not drill holes or weld attachments to beams and other structural members without prior written approval from the Owner.

D. The Work shall be done by craftspersons skilled in the particular trades affected.
E. Patching materials shall match existing materials in type and quality. Patching shall be done in a manner to match appearance of adjacent surfaces.

3.07 CLEANING

A. Cleaning shall occur on a daily basis in order to maintain a clean, orderly job site.
B. Cleaning shall be performed to the satisfaction of the Owner.
C. Unless otherwise indicated, clean shall mean free of dust, dirt, mud, debris, oil, grease, residues, and contamination. Acceptability shall be determined by sight, touch, and wiping with a clean soft cloth and suitable cleaning agent.

3.08 SLEEVES

A. If not provided by the electrical Contractor, the Contractor is required to provide their own sleeves (including nylon bushings) for new conduit and cable penetrations of building construction.
B. Use electrical metallic tubing sleeves for penetrations through exterior masonry/concrete walls and foundations, concrete floor slabs on grade and above grade, and concrete-filled decks
C. Use only fire-rated listed assemblies for the type of sleeve being installed through CMU walls or gypsum walls for communications penetrations. Sleeve type shall be electrical metallic tubing.
D. Secure sleeves firmly in place using filling and patching materials that match with surrounding construction.
E. In floor penetrations, extend sleeve 4” above finished floor unless noted otherwise. In wall penetrations, cut sleeves flush with wall surface and use metal escutcheon plates in finished interior areas.
F. Seal voids between sleeves and building construction with joint sealants. Make allowances for and coordinate the Work with installation of firestopping, conduit insulation, and waterproofing, as applicable.

3.09 PENETRATIONS OF BUILDING SURFACES

A. If not provided by the electrical Contractor, the Contractor is required to provide their own building penetrations.
B. Provide through-penetration firestop systems for penetrations through fire-rated walls, floors, and other partitions of building construction.
C. Above Grade Level or Non-waterproof Areas
    1. Seal each annular space between conduits or cable and building surfaces. Pack space with Oakum, other rope packing, or backer rod materials and cover with fire-resistant sealant or other protection materials.
    2. Provide sleeves as specified in “Sleeves” section above for conduit and cable penetrations. Seal each space between conduit or cable and sleeve.
D. Waterproof Areas (Above and Below Grade)
    1. In new and existing construction for penetrations through concrete below grade, ground water level or in other waterproof areas, provide through-wall and floor seals having galvanized fittings, sealing assemblies, and sleeves as specified.
    2. In existing construction when core bore drilled openings are used for conduit penetrations below grade, ground water level, or in other waterproof areas, provide sealing.

3.10 CONTINUITY OF SERVICES

A. Take no action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the Architect/Technology Consultant. Arrange the work to minimize shutdown time.
B. Owner’s personnel will perform shutdown of operating systems. The Contractor shall give five (5) days’

advance notice for systems shutdown.

3.11 PAINTING

A. Touch up marred and bared surfaces of primed, galvanized, and finish painted equipment, materials, and accessories installed.
B. Restore patched surfaces as close to the original condition and finish as reasonably possible. Where patching occurs in smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received two coats of primer and two coats of finished paint.

3.12 COMPLIANCE WITH LAWS AND REGULATIONS

A. The awarded Contractor's performance shall comply with all applicable federal, state, and local laws, rules and regulations.
B. The awarded Contractor shall give required notices, shall procure necessary governmental licenses and inspection, and shall pay all fees and charges in connection to the required notices, licenses, and inspections.
C. Federal Communications Commission
    1. Any equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.
D. Codes, Standards, and Ordinances
    1. All work performed on this Project will be installed in accordance, but not limited to, with the following guidelines:
        a. The current edition of the National Electrical Code® 568-2005 Edition.
        b. The ANSI/NECA/BICSI 568-2005 Standard for Installing Commercial Building Telecommunications Cabling.
        c. The current edition of the BICSI Telecommunications Distribution Methods Manual.
        d. The current edition of the BICSI Cabling Installation Manual.
        e. The latest issue of the ANSI/TIA/EIA Standards as published by Global Engineering Documents as ANSI/TIA/EIA Telecommunications Building Wiring Standards.
        f. Infocomm/BICSI – AV Design Reference Manual.
        g. All local codes and ordinances.

3.13 SAFETY

A. All Contractors shall take the necessary precautions and bear the sole responsibility for the safety of the methods employed in performing the work.
B. The Contractor shall at all times comply with the regulations set forth by federal, state, and local laws, rules, and regulations concerning "OSHA" and all applicable state labor laws, regulations, and standards.

End of Section 270000

Section 271000 - Structured Cabling & Communications Equipment Room Fittings

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.
B. Related Specification Sections:
   1. 270000 – General Technology Requirements
   2. 274000 – Integrated A/V Systems & Equipment
   3. 278000 – Network Infrastructure Equipment

1.02 PROJECT SUMMARY

A. The following buildings/sites are part of this project:
   1. Dorothy M. Busch Branch Library (City of Warren), 23333 Ryan Road, Warren, Michigan 48091
B. The contractor is responsible for all labor, products, and materials necessary to install a complete plenum rated structured cabling system that will be utilized as shown in the drawings, including, but not limited to: backboards, cable supports, raceway, and cable management required to complete the system.
C. Where adequate pathways are not provided by the electrical contractor, each contractor is required to provide their own penetrations, sleeves, and cores with firestopping.
D. Any new data and voice locations will be connected via Category 6 Unshielded Twisted Pair (UTP) back to the nearest telecommunication room (MDF/IDF), on the same floor.
E. All patch panels, patch cables (3-7 foot in closet side, 10 and 15 foot on edge device side).
F. Electrical systems will be provided by others.

1.03 SUBMITTALS

A. Manufacturer's technical data, specification sheets, maintenance manuals, and material safety data sheets must be provided within the contractor's bid proposal for the products listed below:
   1. Wire and Cable
   2. Outlets, Termination Jacks, Faceplates, and Connectors
   3. Terminal Blocks and Patch Panels
   4. Enclosures, Racks and Equipment Housings
   5. Firestopping Material
B. Bill of materials, noting long lead time items.
C. Project schedule
   1. Contractors shall provide a detailed project schedule within their bid proposal, including all major work components that materially affect any other work within the project and projected building completion timeframes.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The following manufacturers are acceptable for the required equipment within this section.
   1. Plenum Rated Cable Plant (Category 6, 4 pair, UTP Cable, Color – Blue)
      a. Commscope or approved equivalent.
   2. Patch Panels
      a. Commscope Universal Patch Panels, Category 6 (48 port as required per wiring closet) or approved equivalent.
   3. Termination Jacks
      a. Commscope Jacks, Category 6 (Color – Orange for data) or approved equivalent.
   4. Patch Cables
      a. Commscope Universal Patch Cables, Category 6 (Color – Blue), non-sleeved ends or approved equivalent.
   5. Faceplates
      a. Commscope Uniprise Solutions, 4-Port Faceplate, Designer with labels, White in color or approved equivalent.
      b. Contractor shall furnish and install blank faceplates on any outlet provided by the electrical contractor for their potential technology use.
      c. Contractor shall furnish and install blanks as required in each faceplate where ports are unused.
B. Cabinets and Racks
   1. IT Cabinet (One total, located in Electrical/MDF 117)
      a. Ortronics or approved equivalent.
      b. Provide freestanding equipment racks to store computer, data storage and networking equipment in the data centers, computer rooms and equipment rooms.
      c. The rack shall be similar to Part Number OR-19-72-T2SD, 72” Height, Clear Finish, by Ortronics.
      d. The rack shall have a static load capacity of 1000 lbs.
C. The data cable shall contain numbers on the jacket illustrating the footage marks, at 10’ intervals.
D. All UTP cable, termination jacks, patch panels, and patch cords must be supplied from one manufacturer.

2.02 FIRESTOPPING MATERIALS

A. Materials may be in the form of caulk, putty, strip, sheet, or devices that shall be specifically designed to fill holes, spaces, and voids at communications penetrations.
B. In addition, firestopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits, and cables.

PART 3 – EXECUTION

3.01 EXAMINATION

A. The awarded contractor must perform a walkthrough of the job sites prior to beginning installation. The walkthrough will be completed in conjunction with the Owner, Construction Manager and Technology Consultant.

3.01 INSTALLATION

A. All Category 6 cabling must meet the ANSI/TIA/EIA T568B cabling specifications. All layouts and preparation of shop drawings and installation supervision shall be performed by a certified cable installer of the proposed solution.
B. All Category 6 cabling must be continuous from the telecommunication room to the end location. Any splices in data cabling are strictly prohibited.
C. The contractor shall provide all necessary galvanized bridle rings and/or J-hooks. The bridle rings and J-hooks shall be connected to the building structure. Bridle rings and J-hooks should be placed no farther than four (4) feet apart.
D. Category 6 cabling shall be installed above the ceiling. The data cable must be installed independently from the ceiling grid and/or other support systems.
E. The Category 6 cable shall not be installed with a bend radius greater than the manufacturer's specifications.
F. The contractor shall ensure that data cables are not kinked, bent, overloaded, crushed, etc.
G. Data cables must be kept 5", at a minimum, from power lines and fluorescent lights.
H. The contractor shall provide a 15' service loop at the end of each data cable.
I. Each data and voice cable shall be labeled with the following information: telecommunication room, patch panel, and port number. For example: *IDF3-B-12* would reference *telecommunication room 3, patch panel B, and port number 12*.
J. Patch panels shall be labeled sequentially.
K. The awarded contractor is required to supply and install all Category 6 patch cables required to connect the patch panel to the network switch.
L. The awarded contractor is to provide and install cable tray or ladder rack as required, except where indicated to be provided by electrical contractor.

3.02 PROJECT DOCUMENTATION

A. Submit three (3) copies of the following required items within one (1) month of the conclusion of the project:
    1. Approved shop drawings and submittals.
    2. Completed field installation drawings (in hard copy and electronic). These drawings should illustrate cable routes from telecommunication room to each location (as-built). In addition, each location shall indentify the telecommunication room, patch panel, and port number. For example: *IDF3-B-12* would reference *telecommunication room 3, patch panel B, and port number 12*.
    3. The awarded contractor is responsible for updating the Owner's current set of as-built drawings. This includes the updates of Visio drawings for each cabinet, update of the CAD as-built drawings with cable pathways, and updating the spreadsheet indicating the information below.
    4. Electronic spreadsheet detailing the following information: location, telecommunication closet, data/voice panel #, data/voice port #, switch stack # ID, switch IP, and switch port #.
    5. Any system manuals that are provided by the manufacturer.
    6. Warranty documents for products listed within this section.
    7. Cable certification test results (in hard copy and electronic).

3.03 WARRANTY

A. Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than twenty (20) years from date of Final Acceptance by the Owner. The Owner shall deem acceptance as beneficial use.
B. Transfer manufacturer's warranties to the Owner in addition to the General System Guarantee. Submit these warranties on each item in list form with shop drawings. Detail specific parts within equipment that are subject to separate conditional warranty. Warranty proprietary equipment and systems involved in this contract during the guarantee period. Final payment shall not relieve the contractor of these obligations.

End of Section 271000

Section 274000 - Integrated A/V Systems & Equipment

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.
B. Related Specification Sections:
   1. 270000 – General Technology Requirements
   2. 271000 – Structured Cabling & Communications Equipment Room Fittings
   3. 278000 – Network Infrastructure Equipment

1.02 PROJECT SUMMARY

A. Proposed “Turnkey” Solution
   1. Procure, install, integrate and configure new A/V Equipment at Dorothy M. Busch Branch Library.
   2. All cabling and patch cords must be included by the contractor.
   3. Placement of equipment, power and low voltage will be agreed upon during initial walkthrough.

1.03 SUBMITTALS

A. Manufacturer’s technical data, specification sheets, maintenance manuals, and material safety data sheets must be provided within the contractor’s bid proposal for the products listed below:
   1. Projector
   2. Projection Screen
   3. Audio Equipment
   4. Blu-Ray Player
   5. A/V Shelf
   6. Mounting Brackets
   7. Cabling
B. Bill of materials, noting long lead time items.
C. Project schedule

PART 2 – PRODUCTS

2.01 AUDIO-VIDEO EQUIPMENT:

A. The following projector is required for this Project:
   1. Epson EX5250 Pro Wireless XGA 3LCD Projector, or equivalent.
B. The following sound field system model is required for this project:
   1. Front Row Juno Classroom Audio System, or equivalent.
      a. System shall be integrated into other A/V equipment indicated in this section.
      b. Provide chest worn transmitter and handheld transmitter for simultaneous operation. Include NiMH

rechargeable batteries and separate charger.
c. All components to provide a complete integrated audio system.

C. The following Blu-Ray Model will be integrated into the solution:
1. LG BD670, or equivalent
D. The following projection screen is required for this project:
1. Draper, Artisan/Series V, or equivalent.
a. Electric motor operated, plastic laminate case, tab tensioned. Ceiling mounted. Housing designed with internal junction box and plug-in wiring connections to allow housing to be installed and connected to building power supply separately from motor and viewing surface.
b. Plastic laminate case, color: black.
c. Motor mounted inside screen roller on rubber isolation insulators. Motor UL certified, rated 110-120V AC, 60 Hz, three wire, instantly reversible, lifetime lubricated with pre-set accessible limit switches. Motor with overload protection and electric brake.
d. Single station control rated 115V AC, 60 Hz with 3-position rocker switch with cover plate to stop or reverse screen at any point.
e. Projection viewing surface: Matt White XT1000V
f. Viewing area: 16:10 format, black masking borders, 109: diagonal, 57-1/2"x92"
g. Provide an extra screen drop with an overall drop of 6 feet with a black masking top border.
h. Projector case to be supported to structure above. All supports to be painted black.

2.02 ASSET TAGGING

A. The awarded vendor will be required to install owner provided asset tags for each major component.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The Owner and Architect/Technology Designer reserve the right to require contractor or staffing changes if deemed to be beneficial to the completion of the Project.
B. The awarded contractor must perform a walkthrough of the job sites prior to beginning installation. The walkthrough will be completed in conjunction with the Owner and Architect/ Technology Designer.
C. Before customer sign off takes place, a walkthrough with the awarded contractor, Owner and Architect/Technology Designer will take place to approve projector locations.
D. Audio/Video Equipment
1. The contractor shall carefully follow instructions in documentation provided by the manufacturer to insure all steps have been taken to provide a reliable, easy-to-operate system.
2. All equipment shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation to provide the maximum field of view and security.
3. All firmware found in the products shall be the latest and most up-to-date provided by the manufacturer. If in the event that a newer firmware revision is released by the manufacturer, during the project but prior to "final" acceptance, the awarded contractor will be required to deploy the latest firmware to the components/products.
4. Before customer sign off takes a place, a walkthrough with the contractor, Owner and Architect/Technology Designer will take place to approve final installations.
5. All equipment requiring users to log on using a password shall be configured with user/site-specific password(s). No system/product default passwords shall be allowed.
6. The awarded contractor will be responsible for configuring each piece of equipment if required.
7. Mounted projectors

a. Provide manufacturer's ceiling mount with the projector.
b. The cabling system must be properly wire managed.

8. Owner provided PCs will be used for the overall solution, to be integrated by the awarded vendor.

3.02 FIELD QUALITY CONTROL

A. All installation, configuration, setup, program, and related work shall be performed by technicians trained by the manufacturer in the installation and service of the equipment provided.
B. The awarded contractor shall maintain a consistent Project team during the duration of the Project.

3.03 DEMONSTRATION AND KNOWLEDGE TRANSFER

A. The following outline the required demonstration and knowledge transfer that is required of this Project. The demonstration and knowledge transfer will be provided at no additional cost to the Owner.
B. End User Knowledge Transfer - The awarded contractor will be required to provide a minimum of four (2) two-hour sessions of knowledge transfer of end user training at no additional cost to the owner.
C. Technical Staff Knowledge Transfer - The awarded contractor will be required to provide a minimum of two (2) four-hour sessions of knowledge transfer at no additional cost to the Owner.

3.04 PROJECT DOCUMENTATION

A. All of the items below must be included in a three-ring binder that will be presented to the Owner at the "close out" meeting. All documentation must also be in electronic non-pdf formats.
B. A set of drawings showing locations of all equipment locations and approximate cable paths.
C. Inventory spreadsheet will includes the following information for all equipment:
   a. Manufacturer
   b. Model Number
   c. Description
   d. Serial Number
   e. Location
   f. Asset Tag Number
D. Documentation (including contact information) on the equipment warranties, technical support, and applicable software assurance.
E. Manufacturer specification/cut sheets for the systems and equipment installed.
F. Installation and programming manuals (3) per book, for all hardware and software components.

3.05 WARRANTY

A. A 5 (five) year warranty end-to-end for labor and materials shall be included as part of the bid response.

End of Section 274000

Section 278000 - Network Infrastructure Equipment

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.
B. Related Specification Sections:
   1. 270000 – General Technology Requirements
   2. 271000 – Structured Cabling & Communications Equipment Room Fittings
   3. 274000 – Integrated A/V Systems & Equipment

1.02 PROJECT SUMMARY

A. Proposed “Turnkey” Solution
   1. Procure, install, integrate and configure new 10Gb Network Infrastructure Equipment at Dorothy M. Busch Branch Library.
   2. All cabling and patch cords within the MDF will be provided by the awarded vendor in order to complete the entire system. It is also the intent that the vendor provides all of the correct cabling to enable stacking for both IP and Power (PoE) purposes.
   3. Additional power, if required, will be provided by others.
   4. Placement of equipment will be verified at a post-award walk-through.

1.03 SUBMITTALS

A. Manufacturer’s technical data, specification sheets, maintenance manuals, and material safety data sheets must be provided within the contractor’s bid proposal for the products listed below:
   1. Cisco Equipment, or equivalent
B. Bill of materials, noting long lead time items.
C. Project schedule

PART 2 – PRODUCTS

2.01 NETWORK INFRASTRUCTURE EQUIPMENT:

A. THE FOLLOWING CISCO EQUIPMENT IS REQUIRED FOR THE NEW NETWORK:

MDF (Electrical 117)

Part Number	Description	Qty
WS-C3850-48PF-S	Catalyst 3850X 48 Port Full PoE IP Base	3
CAB-3KX-AC	AC Power Cord for Catalyst 3K-X (North America)	6
S375XVK9T-12253SE	CAT 3850X IOS Universal with Web Base Dev Mgr	3

C3KX-NM-BLANK	Catalyst 3K-X Network Module Blank	3
C3KX-PWR-1100WAC	Catalyst 3K-X 1100W AC Power Supply	3
PI-MSE-PRMO-INSRT	Insert, Packout – PI-MSE	3
C3KX-PWR-1100WAC/2	Catalyst 3K-X 1100W AC Secondary Power Supply	3
CAB-STACK-50CM	Cisco Stackwise 50CM Stacking Cable	3
CAB-SPWR-30CM	Catalyst 3850X Stack Power Cable 30 CM	3
SFP-10G-SR	10GBASE-SR SFP Module	3

B. THE FOLLOWING UNINTERRUPTIBLE POWER SUPPLY (UPS), OR EQUIVALENT, IS REQUIRED FOR THE NEW NETWORK:

Part Number	Description	Qty
APC SUA1500	APC Smart-UPS 1500VA USB & Serial RM 2U 230V	1

2.02 ASSET TAGGING

A. The awarded contractor will be required to install asset tags on all major pieces of equipment.
B. The Owner will provide asset tags.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The Owner and Architect/Technology Consultant reserve the right to require contractor or staffing changes if deemed to be beneficial to the completion of the Project.
B. The awarded contractor must perform a walkthrough of the job site prior to beginning installation. The walkthrough will be completed in conjunction with the Owner and Architect/Technology Consultant.
C. All cardboard boxes and shipping containers must be disposed of off-site. Disposal of these items within the Owner's dumpsters are strictly prohibited. Disposal must take place on a daily basis.
D. Network Core Installations:
    1. The contractor shall carefully follow the specified manufacturer's best practices for design and installations through-out this project.
    2. All firmware found in the products shall be the latest and most up-to-date provided by the manufacturer. If in the event that a newer firmware revision is released by the manufacturer, during the project but prior to "final" acceptance, the awarded contractor will be required to deploy the latest firmware to the components/products.
    3. The Design Engineer will be required to review current configurations and design the new systems to integrate into the remaining network WAN and LAN. If there is any re-work of existing equipment, it will be the awarded contractor's responsibility to update any configurations on existing equipment.
    4. All equipment requiring users to log on using a password shall be configured with user/site-specific password(s). No system/product default passwords shall be allowed. .
    5. The awarded contractor is to label all new equipment and create as-built drawings detailing port usage and show unused ports on the new equipment at time of close-out.

3.02 FIELD QUALITY CONTROL

A. All installation, configuration, setup, program, and related work shall be performed by technicians trained by the manufacturer in the installation and service of the equipment provided.
B. The awarded contractor shall maintain a consistent Project team during the duration of the Project.

3.03 DEMONSTRATION AND KNOWLEDGE TRANSFER

A. End User Knowledge Transfer - The awarded contractor will be required to provide two (2) four (4) hour training session to a minimum of 2 end users on the use of all systems deployed through this RFP.

3.04 PROJECT DOCUMENTATION

A. All of the items below must be included in a three-ring binder that will be presented to the Owner at the "close out" meeting. All documentation must also be in electronic non-pdf formats.
B. Inventory spreadsheet will includes the following information for all equipment:
    1. Manufacturer
    2. Model Number
    3. Description
    4. Serial Number
    5. Location
    6. Asset Tag Number
C. Documentation (including contact information) on the equipment warranties, technical support, and applicable software assurance.
D. Manufacturer specification/cut sheets for the systems and equipment installed.
E. Installation and programming manuals (3) per book, for all hardware and software components.

3.05 WARRANTY

A. A 5 (five) year warranty end-to-end for labor and materials shall be included as part of the bid response.

End of Section 278000

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping, or sealing site utilities.
7. Temporary erosion and sedimentation control.

1.2 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project Site.

1.3 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
2. Use only hand methods or air spade for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks, driveway approaches and pavements.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct pre-excavation conference at Project Site.

1.4 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.5 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

B. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Topsoil: Provide reusable excavated (approved by landscape architect) or imported as required.

B. If reusable, stockpiled topsoil is insufficient, provide additional as required to complete the work. All material shall be friable loam, free of subsoil, roots, grass, excessive amounts of weeds, stone, and foreign matter.

C. Document quantities with weight tickets from independent weigh house.

D. Furnish written statement giving location and recent use of topsoil proposed for approval before delivery.

E. Subsoil: Reusable excavated or imported material shall be graded free of lumps larger than 6 inches and rocks larger than 3 inches, and miscellaneous debris.

2.2 FILL MATERIAL

A. 'Type A' (trench backfill) – granular materials used for pavement subbase shall meet Michigan Department of Transportation "2012 Standard Specifications for Construction" for "Class II" material, graded in accordance with Table 902-3. When Class II material is specified, Class I material may be substituted.

B. 'Type B' (aggregate base) – gravel shoulder and base course for drives and parking areas shall meet Michigan Department of Transportation "2012 Standard Specifications for Construction", 21AA limestone aggregate, graded in accordance with Table 902-2.

C. 'Type C' (stone for pipe bedding) – Stone shall meet the requirements of Series 6A aggregate, per the Michigan Department of Transportation Standard Specifications for Construction – 2012.

D. 'Type D' (embankment) – sand, natural river or bank sand, free of silt, clay, loam, friable or soluble materials, and organic matter.

E. 'Type E' (embankment) – select subsoil, consisting of not more than 15% clay or 20% silt and clay combined, free from scrap or other deleterious material, clean and unfrozen.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Notify Architect/Engineer immediately of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

C. Identify and flag known utility locations. Hand dig to verify horizontal and vertical locations of all underground utilities with project area.

D. Maintain and protect existing utilities remaining which pass through Work area.

E. Verify foundation walls are braced to support surcharge forces imposed by backfilling operations.

3.02 PROTECTION OF ADJACENT WORK

A. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

B. Grade project area to prevent surface water run-off into excavation or to adjacent properties. Install soil erosion control measure prior to starting any site excavation or grading.

3.03 EXCESS WATER CONTROL

A. Do not place, spread, or roll and fill material during unfavorable weather conditions. Do not resume operations until moisture content and fill density are satisfactory to the soils Engineer.

B. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collecting in depressions.

C. Where soil has been softened or eroded by flooding or replacement during unfavorable weather, remove all damaged areas and recompact as specified.

D. Provide and maintain at all times during construction, ample means and devices with which to remove promptly and dispose of all water from every source entering the excavations or other parts of the work.

E. Dewater by means which will ensure dry excavations and the preservation of the final lines and grades of bottoms of excavations.

3.04TOPSOIL EXCAVATION

A. Do not excavate wet topsoil or topsoil with moisture content that exceeds plastic limit of material.

B. Excavate topsoil and stockpile in area designated by Architect/Engineer, and Owner on site, (after landscape architect approves quality of material) remove excess topsoil not being reused from site.

C. Do not excavate topsoil during unfavorable weather conditions such that the quality of construction may be impaired.

3.05 SUBSOIL EXCAVATION

A. Excavate subsoil to reach suitable bearing or as required for construction operations, and other Work. Excavate to depths shown and as required for retaining walls, pavement subbase, and other work as shown or specified.

B. Do not excavate subsoil during unfavorable weather conditions such that the quality of construction may be impaired.

C. Machine slope banks to angle of repose or less, until shored.

D. Excavation shall not interfere with normal 45 degree bearing splay of any existing or proposed foundation, road, or parking area.

E. Load bearing capacity of subsoil excavation at retaining wall footing level must exceed a minimum of 2000 lbs. per sq. ft.

F. If satisfactory subsoil conditions are not found at depth indicated on drawings, revise footings and excavations as directed by Architect/Engineer. Such additional work shall be paid for in accordance

with unit prices as calculated for comparable work in proposal provided that such unit prices will not become an unfair burden on the Owner or Contractor.

G. If any piping, drains, construction materials, etc., are encountered in excavating, unless ordered removed, shall be supported, braced and protected from damage. If utility lines are encountered, the Contractor shall notify the Architect/Engineer and not disturb lines unless so approved. Cooperate with the Owner and Architect/Engineer in their determination of additional work necessary.

H. Protect bottoms of excavations from frost. Provide, maintain and operate sufficient pumping equipment to keep all excavations free from water at all times. Discharge water a sufficient distance from foundations to prevent damage to work.

I. Legally dispose of excavated subsoil away from site.

J. The site shall be balanced onsite. The Contractor shall estimate the earthwork quantities and notify the Engineer/Architect if he believes the site will not balance. The costs to balance the site shall be included in the base bid.

3.06 TRENCHES

A. Excavate for storm sewer & miscellaneous piping on site to depths indicated and through whatever substances encountered.

B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection. Excavated material shall be piled a sufficient distance from banks of excavation to avoid overloading and to prevent slides and cave-ins.

C. All excavation shall be made by open cut unless otherwise indicated.

D. The banks of trenches shall slope or be supported in accordance with all pertinent rules and regulations.

E. Trenches shall be no less than 12 inches nor more than 16 inches wider than the outside diameter of the pipe laid therein, and shall be excavated true to line, so that clear space of not less than 6 inches nor more than 8 inches in width is provided on each side of the pipe. The maximum width of the trench specified applies to the width of any point below the level of the top of the pipe. The width of the trench above that level may be as wide as necessary for sheathing and bracing, and the proper installation of the work, but care shall be taken not to injure abutting property.

F. Hand trim excavation and leave free of loose matter. Hand trim for bell and spigot pipe joints. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for sections where it is necessary to excavate for bell holes.

G. Excavate approximately 4” deeper than the required level, and bed the pipe or appurtenances in clean ‘Type A’ material unless otherwise shown on the construction plans. The bedding material shall be added to extend upward at least half the diameter of the pipe or 12”, whichever is higher. This bedding procedure will be used in all cases of over excavation at the expense of the Contractor.

H. Support pipe during placement and compaction of bedding fill. Backfill and compact each side of pipe equally and concurrently.

I. Excavation for catch basin structures, and other accessories shall be sufficient to leave at least 24 inches clearance between their outer surfaces and the embankment or timber which may be used to hold the banks and to protect them.

J. After the jointing is completed and the pipe has been approved, the trench shall be backfilled by hand to a one foot depth over the top of the pipe. The backfill materials shall be placed evenly around and over the pipe in six inch layers and thoroughly compacted by tamping. Remaining backfill to be placed to required contours and elevations.

K. Trench backfill within the limits of asphalt or concrete paving shall require special compaction to a density not less than 95% of the maximum density determined by the Test ASTM D1557 (Modified Proctor).

L. Backfill and compaction around structures and other appurtenances shall be in lifts not to exceed 8 inches and shall be compacted to a density not less than 95% of the maximum density determined by the Modified Proctor Test ASTM D698-70.

3.07 BACKFILLING

A. Backfill areas to contours and elevations, using unfrozen materials.

B. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place and compact fill materials in continuous layers not exceeding 8 or 12 inches loose depth as indicated in the schedule below.

D. Employ a placement method so as not to disturb or damage foundation perimeter drainage or utilities in trenches.

E. Maintain optimum moisture content of backfill materials to attain required compaction density.

F. Do not backfill against unsupported foundation walls.

G. Slope grade away from building, minimum of 1.0% unless otherwise noted.

3.08 PLACING TOPSOIL

A. Place topsoil in areas where seeding is scheduled or over entire area within contract limits to a rolled depth of 4”. Provide additional topsoil if required to complete the work.

B. Fine grade topsoil eliminating rough or low areas. Maintain levels, profiles, and contours of subgrade.

C. Remove stone, roots, grass, weeds, debris, and foreign material while spreading.

D. Lightly roll placed topsoil.

E. Leave site clean and raked, ready to receive landscaping.

3.09 TESTS

A. Tests and analysis of fill materials will be performed in accordance with ANSI/ASTM D1557.

B. Contractor and testing laboratory shall confirm with Architect/Engineer selected test points and frequency.

3.10 TOLERANCES

A. Top surface of exposed subgrade: plus or minus 0.10'.

B. Top of topsoil: plus or minus 0.10'.

3.11 SCHEDULES

A. Exterior side of retaining wall. Material for this backfill shall be 'Type A' for a distance of five feet from the foundation walls. Each 8" lift shall be compacted to 95%. Backfill beyond the five feet limit shall be 'Type E', compacted in 12" lifts to 90%.

B. Fill under landscaped areas, subsoil 'Type E' as required to meet design grades, compacted in 12" lifts to 85%. Hold down 4" to accommodate topsoil installation.

C. Subbase fills under parking lots and streets where required: 'Type B', depth as indicated on drawings, compacted in 8" lifts to 95%.

3.12 COMPACTION

A. Compacting equipment shall be heavy duty, 20 ton minimum capacity, rolling drum, vibrating compactors or other compacting equipment may be used with the approval of the Soils Engineer retained to observe proof compaction.

B. Compacting equipment shall not require more than six passes to obtain specified density.

C. The above methods or other suitable methods capable of producing equivalent results with the available material may be used with the approval of the Testing Laboratory and the Soils Engineer.

D. Compacting around concrete pedestals and next to foundation walls shall be with hand operated vibrating compactors for granular soils and Barco rammer type compactors for clay soils.

E. Granular soils of relatively uniform grain size and very small amounts of fine binder material may have their density established by the Relative Density (ASTM D2049) method. Compaction of all cohesionless soil fill shall be at least 75% Relative Density.

F. If fill material is too dry, the Contractor shall provide and operate approved means to add moisture to layers.

G. The moisture content shall be checked by the Testing Laboratory and operations concerning placing fill shall be under their control.

END OF SECTION 312000

SECTION 312500 – SOIL EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary and permanent measures for soil erosion and sedimentation prevention and control.

1.02 SYSTEM DESCRIPTION

A. Methods of control are identified on the Soil Erosion and Sedimentation Control drawings.

B. Additional control measures shall be employed as required by site conditions and applicable governing agencies having project jurisdiction.

1.03 QUALITY CONTROL

A. Perform and maintain Work in accordance with the Soil Erosion and Sedimentation Control Act 347 of 1972, any amendments to, and corresponding rules of the Michigan Water Resources Commission.

1.04 REGULATORY REQUIREMENTS

A. Contractor shall obtain all permits and pay all fees for plan review and inspection as required by applicable governing agencies having project jurisdiction.

B. Detailed soil erosion control plan is required for all projects that are within 500 feet of any water course, or are one (1) acre or more in area.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Permanent Measures: In accordance with applicable Section for specified material.

B. Temporary Measures: In accordance with Standards and Specifications for Soil Erosion and Sediment Control published by the Association of Soil Conservation Districts.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify and flag known utility locations. Notify utility company to remove or relocate utilities as required.

C. Maintain and protect existing utilities to remain.

3.02 PROTECTION OF ADJACENT WORK

A. Protect adjacent structures and property which may be damaged by execution of Work.

B. Protect existing trees, shrubs, landscaping and lawn areas designated to remain.

3.03 INSTALLATION AND MAINTENANCE

A. Construct soil erosion and sedimentation control measures in accordance with approved plans and requirements of applicable governing public agency.

B. Schedule planned control measures with construction operations to limit the area of any disturbed land to the shortest possible period of exposure.

C. Conduct all earth changes so as to effectively reduce accelerated soil erosion and resulting sedimentation.

D. Remove all sediment from runoff water before it leaves the site.

E. Roads, driveways, and parking lots must be kept clean at all times during construction.

F. Inspect, maintain, and repair temporary control measures until permanent control measures are implemented.

G. Maintain permanent control measures until final acceptance by Owner.

3.04 SOIL EROSION AND SEDIMENTATION CONTROL MEASURES

A. Permanent and minimum temporary control measures as scheduled on Drawings.

END OF SECTION 312500

SECTION 321216 – ASPHALT PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

B. Bituminous concrete paving

1.02 RELATED REQUIREMENTS

A. Section 310000 Earthwork.

B. Section 330513 Manholes and Structures.

1.03 RELATED REQUIREMENTS

A. AI MS-2 -Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994.

B. AI MS-19 -A Basic Asphalt Emulsion Manual; The Asphalt Institute; Third Edition.

C. ASTM D 946 -Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 1982 (Reapproved 2005).

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with MDOT 2012 Standard Specifications.

B. Mixing Plant: Conform to MDOT 2012 Standard Specifications.

C. Obtain materials from same source throughout.

1.05 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F.

B. Place bitumenous mixture when temperature is not more than 15 F degrees below bitumenous supplier's bill of lading and not more than maximum specified temperature.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Asphalt Wearing Course; In accordance with MDOT 2012 Standard Specifications for MDOT 13A Mix.

B. Asphalt Leveling Course; In accordance with MDOT 2012 Standard Specifications for MDOT 3C Mix.

C. Aggregate for Base Course; MDOT 2012 Standard Specifications for MDOT 21AA Crushed Limestone Aggregate.

D. Fine Aggregate Sand; In accordance with MDOT Class II sand.

E. Primer: In accordance with MDOT 2012 Standard Specifications.

F. Tack Coat: In accordance with MDOT 2012 Standard Specifications.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.03 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with MDOT 2012 Standard Specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade; granular base and stabilized soil are dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

A. Place and compact base course to 98% of its maximum unit weight.

3.03 PREPARATION .. PRIMER ASPHALT PAVING

A. Apply primer in accordance with manufacturer's instructions.

B. Apply primer to contact surfaces of curbs.

3.04 PREPARATION -TACK COAT

A. Apply tack coat in accordance with manufacturer's and MDOT Standard Specifications.

B. Apply tack coat to contact surfaces of curbs.

3.05 PLACING ASPHALT PAVEMENT

A. Install Work in accordance with 2012 MDOT Specification for Construction.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Place asphalt to required compacted thickness.

D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.06 PLACING ASPHALT OVERLAY

A. Apply tack coat to existing paving surface in accordance with manufacturer's and MDOT Standard Specifications.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Place asphalt to required compacted thickness.

D. Compact overlay by rolling.

E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

F. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.07 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

3.08 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 3 days or until surface temperature is less than 140 degrees F.

END OF SECTION 321216

SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks, drive approaches and flat work

1.02 RELATED REQUIREMENTS

A. Section 312000 – Earth Moving; Preparation of site for paving and base.

B. Section 321216 – Asphalt Paving.

1.03 REFERENCE STANDARDS

A. ACI 211.1 -Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).

B. ACI 301 -Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.

C. ACI 304R -Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

D. ACI 305R -Hot Weather Concreting; American Concrete Institute International; 1999.

E. ACI 306R -Cold Weather Concreting; American Concrete Institute International; 1988 (Reapproved 2002).

F. ASTM A 185/A 185M -Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

G. ASTM A 497/A 497M -Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.

H. ASTM A 615/A 615M -Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2007.

I. ASTM C 33 -Standard Specification for Concrete Aggregates; 2007.

J. ASTM C 39/C 39M -Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2005.

K. ASTM C 94/C 94M -Standard Specification for Ready-Mixed Concrete; 2007.

L. ASTM C 150 -Standard Specification for Portland Cement; 2007.

M. ASTM C 173/C 173M -Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2007.

N. ASTM C 260 -Standard Specification for Air-Entraining Admixtures for Concrete; 2006.

O. ASTM C 309 -Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.

P. ASTM C 494/C 494M -Standard Specification for Chemical Admixtures for Concrete; 2008.

Q. ASTM C 618 -Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2005.

R. ASTM C 685/C 685M -Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2007.

S. ASTM D 1751 -Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types); 2004.

T. ASTM D 1752 -Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a.H. The Contractor shall not add fill until the subgrade in place has been approved by the soils lab.

PART 2 - PRODUCTS

2.01 PAVING ASSEMBLIES CONCRETE

A. Comply with applicable requirements of ACI301. City of Warren Standards and MDOT Standards.

B. Concrete Sidewalks: 3,500 psi 28 day concrete, 4 inches thick.

C. Concrete Drive Approaches, Sidewalk across Drive Approaches and Flatwork: 3,500 psi 28 day concrete, 8 inches thick.

2.02 FORM MATERIALS

A. Form Materials: Conform to AC1301; As specified in City of Warren Standards and MDOT Standards.

B. Wood; Steel; or form material, profiled to suit conditions.

C. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751); sponge rubber or cork (ASTM D 1752).

2.03 CONCRETE MATERIALS

A. Obtain cementitious materials from same source throughout.

B. Concrete Materials: Provide in accordance with MDOT 2012 Standard Specifications for Construction Standard P1 mix.

C. Cement: Portland Cement as described in Division 6 of the MDOT 2012 Standard Specifications.

D. Fine and Coarse Mix Aggregates: ASTM C 33.

E. Water: Clean, potable, and not detrimental to concrete.

F. Air Entrainment Admixture: ASTM C 260.

G. Chemical Admixtures: ASTM C 494/C.
   1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.04 ACCESSORIES

A. Curing Compound: ASTM C 309, Type 2.

B. Joint Sealer: Type as specified in the MDOT 2012 Standard Specifications, Section 914.

2.05 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience; trial mixtures; or , as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Design Professional for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Concrete Properties:
   1. As detailed in the MDOT 2012 Standard Specifications for P1 Mix.

2.06 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C 685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C 94/C 94M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade; granular base; stabilized soil; or is acceptable and ready to support paving and imposed loads.

3.02 SUBBASE

A. See Section 312000 for construction of base course for work of this Section.

B. Prepare subbase in accordance with MDOT and the Soils Engineers' recommendations.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Verify gradients and elevations of base are correct.

C. Notify Design Professional minimum 24 hours prior to commencement of concreting operations.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

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.

3.05 COLD AND HOT WEATHER CONCRETING

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Do not place concrete when base surface temperature is less than 40 degrees F; or surface is wet or frozen.

3.06 PLACING CONCRETE

A. Place concrete in accordance with AC1304R; as specified in Section 033000.

B. Place concrete in accordance with MDOT Standards.

C. Do not place concrete when base surface is wet.

D. Placing concrete using the slip form technique is acceptable.

E. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

F. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

G. Place concrete to pattern; or pattern indicated.

3.07 JOINTS

A. Align sidewalk joints.

B. Provide scored or sawn joints between sidewalks.

C. Place joints in accordance with MDOT standards.

D. Saw cut contraction joints at an optimum time after finishing.

3.08 FINISHING

A. Paving: Light broom, texture perpendicular to pavement direction.

B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel.

C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.09 JOINT SEALING

A. See Section 079005 for joint sealer requirements.

3.10 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch.

B. Maximum Variation From True Position: 1/4 inch.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01400. Provide free access to concrete operations at project site and cooperate with appointed firm. Submit proposed mix design of each class of concrete; or None -N/A to inspection and; or None -N/A testing firm for review prior to commencement of concrete operations. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three; concrete test cylinders. Obtain test samples for every 75 cu yd; less of each class; of concrete placed. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

END OF SECTION 321313

SECTION 321316 - DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes colored concrete paving.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of exposed color, pattern, or texture indicated.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches (2400 mm) by 96 inches (2400 mm).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

2.4 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100.

B. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation-Construction Systems.
b. Brickform; a division of Solomon Colors.
c. Davis Colors.
d. Scofield, L. M. Company.
e. Solomon Colors, Inc.
f. Specialty Concrete Products, Inc.
g. Stampcrete International, Ltd.

2. Color: Refer to ‘Material Finish / Color Schedule Section 000200’ for color selections.

F. Water: Potable and complying with ASTM C 94/C 94M.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

B. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.

1. For integrally colored concrete, curing compound shall be pigmented type approved by coloring admixture manufacturer.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M).

1. Compressive Strength (28 Days): 3500 psi
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches plus or minus 1 inch.
4. Air Content: 6 percent plus or minus 1.5 percent.

B. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

3.4 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

B. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

D. Screed paving surface with a straightedge and strike off.

E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

3.8 INTEGRALLY COLORED CONCRETE FINISH

A. Integrally Colored Concrete Finish: After final floating, apply the following finish:
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Compound: Apply immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

   1. Cure integrally colored concrete with a pigmented curing compound.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 (ACI 117M).

3.11 REPAIR AND PROTECTION

A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321316

SECTION 321600 – CONCRETE CURB AND GUTTER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This work includes all preparation, forming, concrete production and placement, finishing, jointing, reinforcing, curing, protection, and restoration for the construction of concrete curb and gutter.

B. The concrete curb and gutter shall be constructed substantially in accordance with the cross section provided on the plans.

C. Curb and gutter may be constructed either by slip-forming or using fixed forms.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland cement shall meet the requirements of ASTM C150.

B. Coarse aggregate shall meet the requirements of Class 6A aggregate as described in the 2012 Michigan Department of Transportation Standard Specifications for Construction.

C. Reinforcing steel shall be grade 60 steel bars meeting the requirements ASTM A615, A616, or A617.

D. White membrane curing compound shall conform to ASTM C309, Type 2, Class B vehicle.

E. Fiber joint filler shall meet the requirements of ASTM D1751.

2.02 MIXTURES

A. Concrete for curb and gutter shall be transit mixed concrete in accordance with ASTM C94.

B. Air content shall be 6.5 +- 1.5%, slump shall not exceed 3 inches, and compressive strength shall be at least 3500 psi after 28 days. Air content for slip form placement shall be 4.5 +- 1.5%, slump shall not exceed 1.5 inches, and compressive strength shall be at least 3500 psi after 28 days. Concrete shall contain at least six sacks of cement per cubic yard of concrete.

PART 3 - EXECUTION

3.01 REMOVAL OF EXISTING CURB AND GUTTER

A. Where the proposed curb and gutter is to replace existing curb and gutter, the existing curb and gutter shall be removed in accordance with the requirements for pavement removal, included elsewhere in these documents.

3.02 PREPARATION

A. The base shall be excavated, filled, and shaped as required to construct the proposed curb and gutter at the elevations and alignment required. The base shall be compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. Soft and yielding material shall be excavated and replaced with suitable soils.

B. Forms, if used, shall extend the full depth of the concrete. Face forms for the exposed curb face are not required. Forms shall be of sufficient strength and staked to prevent springing or yielding after placement of concrete. Flexible forms capable of making a smooth arc shall be used for curved sections.

C. Steel reinforcement shall be placed as shown on the plans. Reinforcing shall be spliced and held in place in a manner approved by the Engineer. Splices shall be overlapped by 10 inches.

3.03 PLACING CONCRETE

A. Concrete shall not be placed until the forms or the prepared grade (if slip forming) have been inspected by the Engineer. Concrete shall be deposited to the full depths and spaded or vibrated to ensure proper consolidation.

B. Joints shall be constructed perpendicular to the surfaces and shall not vary more than 1/4 inch from their designated position. Contraction joints shall be spaced at 50 foot intervals and shall be at least 1/4 the thickness of the section. Steel reinforcing shall not extend through contraction joints. Expansion joints shall be constructed at spring points, at intervals not exceeding 400 feet, and 10 to 50 feet each side of a drainage structure. Expansion joints shall be 1 inch thick and extend through the full cross section of the curb and gutter. Plane-of-weakness joints shall be provided at uniform spacing, not exceeding 10 feet. Plane-of-weakness joints shall extend through at least 1/4 the thickness of the section.

C. The edges of the gutter, the back of the top edge of curb, and all transverse joints shall be rounded with a finishing tool having a radius of 1/4 inch. The face of the curb, at the top and bottom, shall be shaped with suitable tools to provide the required radius.

D. Any material required to fill low spots shall be obtained from the mixture used in the work. Exposed surfaces shall be finished smooth and even by means of a moistened wood float, followed by light brushing.

E. The gutter and top of curb shall not vary more than 3/16 inch in 10 feet when using a 10 foot straight edge. Other surfaces shall not vary more than 3/8 inch in 10 feet.

F. Water shall not be added as an aid to finishing.

G. Exposed concrete surfaces shall be cured using white membrane curing compound applied uniformly at a rate of 200 square feet per gallon. Curing compound shall be applied regardless of temperature or humidity conditions.

3.04 PROTECTION

A. Concrete shall not be placed when the air away from artificial heat is at least 25F and rising. Concrete shall be protected from damage by freezing or precipitation.

B. The Contractor shall provide barricading and security as necessary to protect fresh concrete from accidental damage or vandalism. Damaged concrete shall be removed to a joint and replaced at the Contractors expense.

3.05 CLEAN-UP AND RESTORATION

A. Forms shall be removed when the concrete has attained sufficient strength. After removal of forms, the curb and gutter shall be backfilled.

B. Areas to be restored with turf shall be backfilled with suitable soil, compacted, and surfaced with four inches of topsoil such that the topsoil surface is flush with the top of curb. Areas to be surfaced with pavement or sidewalk shall be backfilled with sand to the bottom of the proposed pavement, sidewalk, or base, and compacted.

C. Where curb and gutter is constructed adjacent to an existing pavement, the void between the curb and gutter and the pavement shall be filled full depth with material in like kind as the existing pavement.

END OF SECTION 321600

SECTION 321723 – PAVEMENT MARKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The work under this section includes, but is not necessarily limited to the furnishing and installation of all materials necessary for placing pavement markings as indicated on drawings and specifications.

1. Markings on concrete pavement areas.
2. Markings on asphalt pavement areas.
3. Markings on existing concrete or asphalt areas.
4. Markings on resurfaced existing pavements.

B. Related Sections include the following:

1. Division 321216 Section “Asphalt Paving.”
2. Division 321313 Section “Concrete Pavement.”

1.03 QUALITY ASSURANCE

A. MDOT Specifications: Unless otherwise indicated on drawings or herein specification, all work under this section shall be performed in accordance with the current 2012 MDOT Standard Specifications for Highway Construction.

B. Physically Handicapped: All marking shall be done in accordance with ADA Requirements.

C. Paint Containers: Each paint container shall be plainly marked, with a durable, weather-resistant marking, showing the name and address of manufacturer or vendor, description of material, batch number, date of packaging and volume and weight of contents.

D. Use only personnel completely trained and experienced in installation of materials and equipment.

1.04 SUBMITTALS

A. Manufacturer's literature: Submit descriptive product data of materials, installation methods and procedures.

B. Certification of compliance: Furnish a certification from manufacturer that material for this project has been sampled, tested and complies with requirements of specifications.

1.05 PRODUCT HANDLING

A. Protection: Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the architect at no additional cost to owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials and products for work under this section shall conform to current 2012 MDOT Standard Specifications for Highway Construction.

2.02 PAVEMENT MARKING PAINT

A. Pavement marking paint shall be fast dry and comply with Section 6.29 of 2012 MDOT Standard Specifications for Highway Construction and shall be selected from the following list of approved products.

COMPANY	IDENTIFICATION	YELLOW	WHITE
Baltimore Paint & Chemical Co.		BP29-56/TM9451	BP29-55/TM9450
DeSantis Coatings, Inc.		12Y-D194/K663	
Ennis Paint Mfg., Inc.		EN-6055	EN-4038
Ennis Paint Mfg., Inc.		EN-6054	
Prismo Universal Corporation		LW86-24D	LW84-95A

B. Provide required colors for all physically handicapped markings, complying with governing agencies having jurisdiction.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Prior to all work of this section, carefully inspect installed work of all trades and verify all such work is complete to the point where installation may properly commence. Verify all pavement markings may be installed in accordance with all pertinent codes and regulations, authorities having jurisdiction and referenced standards.

B. Discrepancies: In the event of discrepancy, immediately notify the architect. Do not proceed with installation in areas of discrepancies until all have been fully resolved.

3.02 SURFACE PREPARATION

A. Cleaning: Prior to application of pavement marking, it shall be marking contractor's responsibility that pavement surfaces are clear, dry and free of all foreign materials.

B. New pavement curing: new bituminous wearing surface shall be in place for period of not less than fourteen days prior to application of Fast Dry pavement markings.

3.03 CONSTRUCTION METHODS

A. Application: Pavement markings shall be solid 4" wide yellow lines or solid 4” wide blue lines for ADA accessible parking and laid out as indicated on drawings. Paint shall be applied uniformly at a minimum rate of sixteen gallons per mile for single 4" solid line. Markings shall be applied so that they adhere adequately to surface.

B. Protection of wet paint shall be responsibility of contractor. Markings obliterated by traffic shall be retraced at contractor's expense.

3.04 DEFECTIVE WORK

A. Improper location: Improperly located markings shall be removed at contractor's expense in a manner acceptable to architect and reapplied in correct locations at contractor’s expense.

B. Material shortage: Markings which are applied with material shortages shall be properly reapplied at contractor's expense.

3.05 CLEAN UP

A. Upon completion of the work of this section, remove all rubbish, trash and debris resulting from work of this section. Leave site in neat and orderly condition.

END OF SECTION 321723

SECTION 321726 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for each type of exposed finish requiring color selection.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

2.2 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

1. Cast-in-Place Detectable Warning Tiles shall be manufactured or supplied by ADA Solutions, Inc. or Armor-Tile.
2. Material: Molded glass- and carbon-fiber-reinforced polyester or Vitrified Polymer Composite (VPC).
3. Color: Federal color #22144.
4. Shapes and Sizes:

    a. Rectangular panel, [24 inches x 60 inches].

5. Dome Spacing and Configuration: [1.67-inch (42.4-mm) spacing].
6. Mounting:

a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

PART 3 - EXECUTION

3.1 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

C. Cast-in-Place Detectable Warning Tiles: Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedment's in wet concrete by tamping or vibrating. Set surface of tile flush with surrounding concrete and adjacent tiles. Remove concrete from tile surfaces and clean using methods recommended in writing by manufacturer.

D. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

E. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Channel drainage systems.
3. Encasement for piping.
4. Manholes.
5. Cleanouts.
6. Nonpressure transition couplings.
7. Expansion joints.
8. Catch basins.
9. Stormwater inlets.
10. Pipe outlets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins: Include plans, elevations, sections, details, frames, covers, and grates.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).

1. Tongue-and-Groove ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets
2. Class IV.

2.3 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.4 CLEANOUTS

A. Plastic Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.5 MANHOLES

A. Standard Precast Concrete Manholes:

1. In accordance with the City of Warren Standard Specifications and current MDOT Standard Specifications.
2. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to

indicated elevation and slope. Include sealant recommended by ring manufacturer. Minimum of two rings per structure.

B. Manhole Frames and Covers:

1. Storm Manhole Frame and Cover: EJ 1040 Type B Cover, as required.

2.6 CATCH BASINS

A. Standard Precast Concrete Catch Basins w/ two foot sumps:
1. In accordance with the City of Warren Standard Specifications and current MDOT Standard Specifications.
2. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer. Minimum of two rings per structure.

B. Frames and Grates:

1. Pavement Catch Basin Frame and Cover: EJ 5080 Type M-1 Cover, as required.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping as shown on the plans.
3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
4. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use Heavy-Duty, top-loading classification cleanouts.

B. Set cleanout frames and covers where shown on the plans.

3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

3.6 CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

3.7 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 334100

SECTION 334600 – SUBDRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Perforated-wall pipe and fittings.

2. Geotextile filter fabrics.

1.02 ACTION SUBMITTALS

A. Product Data: For geotextile filter fabrics.

PART 2 - PRODUCTS

2.01 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.

2.02 SOIL MATERIALS

A. Soil materials are specified in Section 312000 “Earth Moving”.

2.03 WATERPROOFING FELTS

A. Materials: Comply with ASTM D 226, Type I, asphalt or ASTM D 227, coal-tar saturated organic felt.

2.04 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 228 Class 2.

2. Styles: Flat and sock.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 “Earth Moving”.

3.02 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches (150 mm) deep and 12 inches (300 mm) wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

E. Install drainage piping as indicated in Part 3 “Piping Installation” Article for foundation subdrainage.

F. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.

H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm).

J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (1590 mm). Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.03 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches (150 mm) between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.

F. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.04 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.

2. Underslab Subdrainage: Install piping level.

3. Retainage-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.

4. Lay perforated pipe with perforations down.

5. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install thermoplastic piping according to ASTM D 2321.

3.05 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.

B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.06 BACKWATER VALVE INSTALLATION

A. Comply with requirements for backwater valves specified in Section 334100 "Storm Utility Drainage Piping.

B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.

C. Install horizontal backwater valves in piping in manholes or pits where indicated.

3.07 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 334100 "Site Storm Utility Drainage Piping.

B. Cleanouts for (Foundation) Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.

3. In nonvehicular-traffic areas, use NPS 4 (DN 100) PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) deep. Set top of cleanout 1 inch above grade.

4. Comply with requirements for concrete specified in Section 033000 "Cast-in-Place Concrete.

C. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

2. Use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.08 CONNECTIONS

A. Comply with requirements for piping specified in Section 334100 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

C. Where required, connect low elevations of foundation subdrainage to stormwater sump pumps. Comply with requirements for sump pumps specified in Section 221429 "Sump Pumps.

3.09 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.

2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600